# SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyright, 1896, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXIV.—No. 10. ESTABLISHED 1845. NEW YORK, MARCH 7, 1896 $3.00 A YEAR. WEEKLY.


## THE MANUFACTURE OF THE HAMMOND TYPEWRITER.

Prominent among the many industries which have grown to large proportions within a comparatively short space of time is that which is devoted to the development and manufacture of the typewriter. This most useful, we might say indispensable invention, which was at first regarded as nothing more than an interesting toy, now gives employment to many thousands of operatives, and entails a heavy investment of capital in numerous large and thoroughly equipped factories. While the various forms of the typewriter, and its busy "click," are familiar to our readers, its internal construction, and the infinite care and nicety of adjustment that enter into its manufacture, may not be so well known. We present in this issue a series of cuts which serve to show the leading details of the well known Hammond typewriter, and the various processes which are adopted in its manufacture.

The Hammond is known as a "typewheel," as distinguished from the "typebar" machines. In the latter, the type is attached at the ends of a series of bars, which are pivoted in a circular frame, each bar carrying one letter and making its own impression upon the paper, which is placed centrally within them. In the Hammond the position is reversed, the type being cast in one integral piece, called the type shuttle (Fig. 4), which is oscillated horizontally upon the outer circumference of an annular ring, called the anvil (Fig. 6), the desired letter being brought into position in front of a hammer which, under the impulse of a spring, drives the paper against the type. The primary object of this arrangement is to secure perfect alignment and an uniform impression.

The first object is gained by arranging centrally and rigidly within the machine a solid steel wheel, or annular disk, called the anvil. This is held in position by a central vertical shaft or pin, which snugly engages an accurately drilled hole in the transverse bar of the anvil. On the outside of this wheel and fitting snugly against its face is a vulcanite shuttle (Figs. 4 and 6), upon which is formed (Fig. 4) the whole of the type which is to be used. On the inside the shuttle is provided with a thin steel web, which is passed

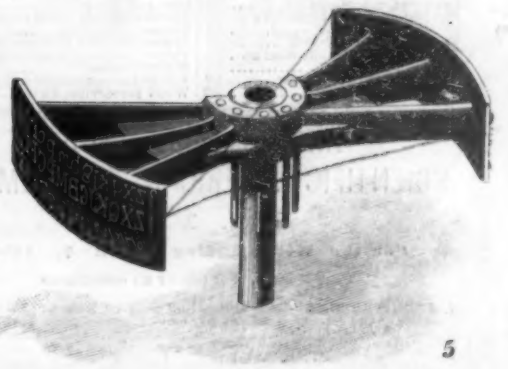
(Continued on page 151.)

1

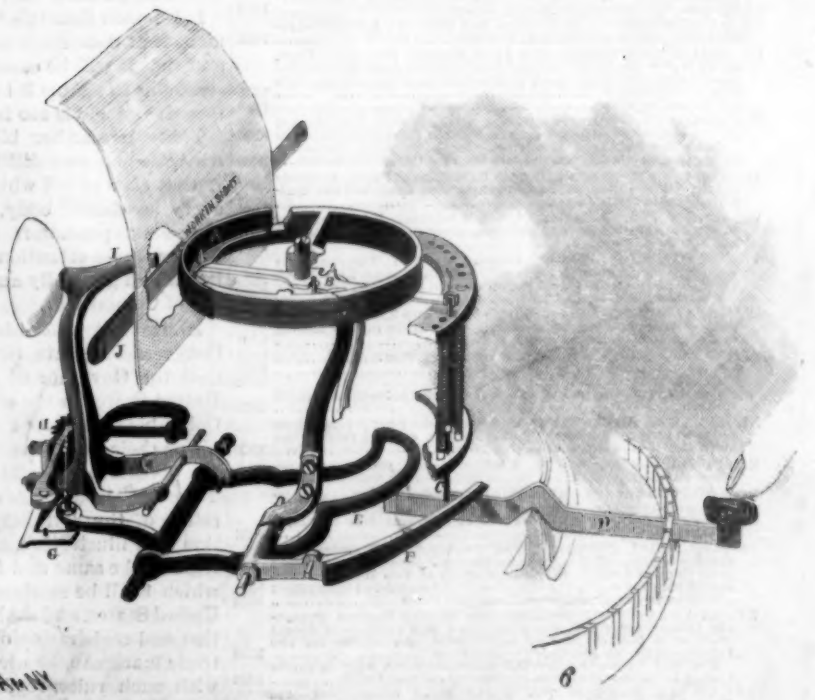
2

7

4



5



6

1. Marking the location of the type. 2. Steel wheel, with type engraved. 3. Vulcanizing plant. 4. Vulcanite shuttle, showing steel web. 5. Original form of shuttle, in two parts. 6. Detail view of type bar and hammer mechanism. 7. The Hammond typewriter complete.

THE MANUFACTURE OF A TYPEWRITER.

# Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

**TERMS FOR THE SCIENTIFIC AMERICAN.**
(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

**The Scientific American Supplement**
(Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

**Combined Rates.**—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of seven dollars. To foreign countries within Postal Union eight dollars and fifty cents a year.

**Building Edition of Scientific American.**
(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing 800r plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

**Export Edition of the Scientific American**
(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, post paid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, MARCH 7, 1896.


**Contents.**

(Illustrated articles are marked with an asterisk.)


Acetylene explosion, the..... 150
Aged, care of the..... 147
Agricultural machinery exhibition..... 154
Aluminum for cooking utensils.. 147
Aluminum making in Norway... 147
American Institute Fair, the.... 148
Belt, from section, to find..... 153
Belt lacing (7 6)*..... 156
Bird's eye photograph*..... 150
Boat propelling device, Forward's*..... 149
Botanic gardens..... 147
Bragdon Naumi*..... 149
Car coupling, Smith's*..... 149
Carriages, motor, in Great Britain 147
Crystals, large, preparations.... 155
Disinfecting plant, portable*.... 149
Drawings, mountings (6748)..... 156
Electric switch, Whitehead's*... 149
Emery..... 153
Exhibition at Innsbruck..... 147
Firing machines, Lilienthal's*... 149
Gas from sawdust..... 147
Ghost and spirit illusions*..... 153
Illusions, X ray*..... 153
Insulator, Riera's*..... 148
Inventions recently patented.... 156
Labrador, expedition to..... 147
Leather belt power conveyance. 151
Mars, spectrum of..... 150
Milk question, the..... 150
Miner's tool and candlestick, Bjoholm's*..... 166
Moulds, gelatine (6748)..... 156
Mouth, the, keep it shut..... 149
Music leaf turner, Adams'*..... 151
Notes and queries..... 156
Patents granted, weekly record. 158
Photographing window displays 150
Photography, Roentgen..... 150
Photography X ray*..... 155
Science notes..... 147
Skeleton and subject*..... 152
Steel rail, life of the..... 155
Thermometer, a novel recording* 149
Thread numbering..... 147
Typewriter, the Hammond*..... 145
Veins of hand photographed*.... 155
Walking upstairs..... 150
Watch demagnetizing coil (6750). 156
Wood preserving, Swiss..... 150


TABLE OF CONTENTS OF

## SCIENTIFIC AMERICAN SUPPLEMENT

## No. 1053.

**For the Week Ending March 7, 1896.**

Price 10 cents. For sale by all newsdealers.


PAGE

I. ARCHITECTURE.—High Office Buildings in New York.—A review of the present status of high buildings in New York City and possible limitation of their heights by law.—1 illustration..... 16826

II. AUTOCARS.—Mechanical Road Carriages.—By W. WORBY BEAUMONT.—Lecture I.—Commencement of a most important series of lectures on the subject of motor vehicles, of great interest and importance at the present day.—2 illustrations..... 16828

III. BACTERIOLOGY.—Dr. Haffkine and Cholera.—A review of recent work in the extirpation of cholera..... 16827

IV. CIVIL ENGINEERING.—The Lady Windsor New Deep Lock, Barry Docks, England. An immense graving dock, the deepest one in the world, giving nearly 30 feet over the sill at ordinary high tide.—1 illustration..... 16825
Engineering Notes..... 16832

V. CHEMISTRY.—Explosive Mixtures of Gases with Air.—Recent results on the proportions of gas required to make it an explosive 16829
Three New Reagents for Nitrites.—By G. DENIGES.—An interesting contribution, giving delicate tests for these compounds.... 16825

VI. CYCLING.—International Bicycle Exposition at Paris.—Interesting exhibits at the recent Parisian exposition described and illustrated.—8 illustrations..... 16827

VII. EDUCATION.—Relations of Geologic Science to Education.—By N. S. SHALER.—True lines on which geology should be treated in institutions of learning..... 16830

VIII. ELECTRICITY.—Recent Improvements in America and Europe in the Storage of Electricity.—By HERBERT LLOYD.—A valuable paper on the recent applications of the storage battery.. 16833
Electrical Notes..... 16832

IX. METALLURGY.—Chilling Test Pieces with Liquid Carbonic Acid.—Cheap and simple form of apparatus for rapidly cooling test specimens of melted steel..... 16827

X. MISCELLANEOUS.—Note on Johannesburg, South Africa..... 16830
Note on Wheat and Rye Crops in Russia..... 16825
Miscellaneous Notes..... 16832
The Music of Niagara.—Attempt to give the notes of the great cataract..... 16827

XI. NAVAL ENGINEERING.—The German Navy.—Interesting notes on the present German navy, with a spirited view of the ships at sea.—1 illustration..... 16830

XII. PHYSICS.—Some Optical Illusions.—Some very simple yet effective experiments in subjective optics.—6 illustrations..... 16826

XIII. PHOTOGRAPHY.—Apparatus for Copying and Enlarging by Photography.—By A. P. WIRE.—A very practical article on this interesting problem, requiring the employment only of simple apparatus.—8 illustrations..... 16824

XIV. POLITICAL ECONOMY.—The Twenty-fifth Anniversary of the Foundation of the German Empire.—Notes on the recent great German festival, with reproduction of Von Werner's celebrated painting of the proclamation of the empire.—1 illustration 16831
Note on the Preservation of Telegraph Poles..... 16831

XV. RAILROAD ENGINEERING.—An English Express Passenger Locomotive for Heavy Grades.—A fine example of recent practice in English railroad engineering.—An engine for the London-Plymouth service.—3 illustrations..... 16834
The Sand Track.—By ROBERT GRIMSHAW.—A very ingenious system for arresting progress of runaway railroad trains..... 16824

XVI. SOCIAL SCIENCE.—The Statistics of Occupations.—Abstract of a recent lecture by U. S. Commissioner CARROLL D. WRIGHT..... 16826

XVII. TECHNOLOGY.—The Manufacture of United States Postage Stamps.—A most interesting account of the way in which postage stamps are printed, gummed, and perforated..... 16826


### PENDING TRADE MARK LEGISLATION.

One of the chief annoyances in the way of the registration of trade marks is the rather foolish and unnecessary requirement that the applicant should make declaration, when applying for registration, that the goods upon which the mark is stamped are used in commerce with a foreign nation or an Indian tribe. This is one of the anomalous requirements of the otherwise admirable statutes now governing the registration of trade marks. It frequently happens that the applicant has extensive trade relations between the States, but engages in no foreign commerce. He is, therefore, in no position to procure the protection granted by the trade mark laws, and before his mark will be registered it is necessary for him to practice what may be called a pious fraud, and ship some goods for sale to Canada or some other neighboring State, whereby he becomes qualified and can subscribe to the required declaration. Such a practice is objectionable and the cause for it should be removed. The commerce between our States is now so enormous that there is no reason why those engaged in such trade should not receive the same recognition before the Patent Office that is accorded to those whose special trade leads them into the channels of foreign commerce. With a view to remedying this feature of our present law, a bill has been introduced into the Senate, and is now in the hands of the Committee on Patents, which seems to possess much merit.

Senate bill No. 1627, the one alluded to, is to amend the present trade mark act so that it shall be applicable to trade marks used in commerce "among the several States."

The old trade mark act of July 8, 1870, based on the patent and copyright clauses of the Constitution, attempted to provide broadly for the registration of any lawful trade mark. This the Supreme Court of the United States decided, in 1879, that Congress had no power to do under those clauses of the Constitution mentioned in said act. The power of Congress to enact trade mark laws must, of course, be found in the federal Constitution. Such power, the court said, could not be found under the eighth clause of section eight of article one, which provides that Congress shall have power to pass laws "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries," because an ordinary trade mark has no necessary relation to invention or discovery. Both inventions and writings involve the element of originality, while a trade mark does not necessarily embody that idea, but is generally nothing more than an adoption of some device or word already in existence, as the distinctive symbol of the person using it. It does not necessarily depend upon novelty, invention, or discovery, but is founded simply upon priority of adoption.

It therefore falls under the provision of the third clause of the same section, which provides that Congress shall have power to regulate "*commerce with foreign nations and among the several States and with the Indian tribes*," and the existing law is based on this clause, but very curiously omits any reference to commerce "among the several States." This defect the present bill aims to correct; it recognizes that fact and is framed in reference thereto. It seems to be in accordance with the requirements of the times, and is needed to protect a very large and important class of trade marks which are in use in commerce among the several States, but which are not in use in Commerce with foreign nations or with the Indian tribes.

It is hoped that this bill will receive the good treatment that it deserves at the hands of the committee, and that it will be considered by them in such good season as to enable it to be passed by the Senate before the session is too far advanced.

There is another bill now before the Committee which is of a very different kind, and which belongs to that class of bill which appears at every session of every legislative body, and which, perhaps, serves to amuse its promoters and those having a sense of humor whose attention may have been called to it, but which generally and quite properly fails to emerge out of Committee.

House bill No. 4,849 has been introduced into Congress to create State trade marks. It provides that the Governor of any State or Territory of the United States or the commissioners of the District of Columbia may adopt a public trade mark, each for his or their respective State, Territory, or District, and file a description and illustration of the same in the Treasury Department of the United States. The Secretary of the Treasury, upon receipt of said description and illustration, and his fee of $25, is required to register the same and issue a certificate of registration which shall be received in evidence in all courts of the United States, and shall be conclusive proof of the adoption and registration of such trade mark. Every such trade mark can be used only under and in accordance with such rules, regulations, and restrictions as may be provided by the laws of the State, Territory, or District adopting and filing the same, and upon goods, wares and merchandise produced, grown or manufactured therein, and upon packages and wrappers containing the same. To infringe such trade mark on goods, wares, or merchandise which are, or which are intended to be, for sale, shipment, consumption or use without and beyond the boundaries of such State, Territory or District is declared to be a misdemeanor, punishable by a fine of not less than one hundred dollars nor exceeding one thousand dollars, or imprisonment for not more than two years, or by both such fine and imprisonment.

This bill is undoubtedly the outgrowth of the Tillman case. Our readers will remember that the history of that case was as follows: On July 15, 1893, Benjamin R. Tillman, Governor of South Carolina, on behalf of said State, filed an application in the Patent Office for the registration of the word "Palmetto" as a trade mark used in the sale of intoxicating liquors. The application was refused by the examiner on the ground that a State of the Union is not within the terms of the law permitting the registration of trade marks, because it does not come within the designation of "person" or "corporation" used therein. On appeal to the Commissioner, the latter refused the application, holding that the State of South Carolina had no authorized sale of liquors outside its own limits. Tillman then applied to the Supreme Court of the District of Columbia for and obtained a mandamus to compel the Commissioner of Patents to register the trade mark as applied for. Thereupon the Commissioner of Patents appealed to the Court of Appeals of the District of Columbia, and that court reversed the judgment below and dismissed the petition on the ground that the trade mark applied for had not been lawfully used in foreign commerce.

It will be noticed that in the pending bill the registration of such State trade marks is made a part of the duty of the Secretary of the Treasury. He has no discretion in the matter. We do not approve of such provision. If a State is by statute to be entitled to register a trade mark, we see no reason why its application for registration should not be filed in the Patent Office, like the applications of "persons" or "corporations," and subject, like those, to being rejected if found to be an infringement upon some mark previously registered. Should the act become a law, however, the courts will undoubtedly be called upon, sooner or later, to decide the power of a State to engage in foreign commerce for the purpose of revenue or profit.

The passage of this bill would lead to endless confusion and litigation, as each State would be authorized to make its own trade mark laws and there is no federal examination and supervision, as the Secretary of the Treasury is instructed to register State trade marks in spite of the fact that he may be aware that such registration may be a direct infringement of the trade marks of some prior applicant, whose rights in the premises the Secretary is summarily forbidden either to question or protect.

### Burning Powdered Coal.

Engineering contains a description of a process which has lately been brought out by Carl Wegener for utilizing powdered coal. The coal, which has been ground to pass through a 60 mesh screen, is fed into a hopper which is located in front of the furnace. At the bottom of the hopper is a grating, which can be agitated from 150 to 250 times to the minute, according to the rapidity of feed desired. The coal dust falls through the grate into the bend of an air supply pipe, which enters the furnace at the top of the furnace door. As it falls into this pipe it is met by the induced draught and carried into the furnace. The interior of the furnace is lined with firebrick for a length of 10 or 12 feet, and has in addition two firebrick bridges. There is no grate and there are no fire doors, so called, the combustion being watched through peep holes. A test was recently made in Berlin of a Cornish boiler, fired first by hand and again by the same coal in a powdered condition. The results show that the dry powdered coal evaporated from and at 212° 9·12 pounds of water per pound of dry coal, as against 6·48 pounds for solid coal, fed by hand stoking. It was claimed that the poor condition of the grate is responsible for the very low results in the latter case. The trial, however, shows good economy for the Wegener system. The grinding costs about 10 per cent of the value of the coal.

A LUMINOUS foresight for use in a bad light with guns of various kinds has been patented in England by Mr. Winans. A tiny incandescent lamp, supplied with current from a simple form of battery concealed in the stock, is mounted within a shield at the muzzle of the gun, and a faint ray of light, calculated to indicate the position of its source, is exposed in the direction of the shooter's eye, and this is sufficient to enable him to obtain the required alignment with the back sight and with the target, be it animate or otherwise. The special application of the sight is for game shooting at night and for service purposes, such, for instance, as the illumination of a machine gun used against torpedo attacks during the night.—Army and Navy Journal.

### An Expedition to Labrador.

An expedition bound for the interior of Labrador will leave Philadelphia in June for the purpose of studying the Eskimo and collecting specimens of the fauna and flora of that region. The party will be commanded by G. H. Perkins and will consist of four students of zoology, geology, botany and archæology and a number of college students and others. Prof. Frank Russell, curator of the University of Iowa, accompanies the expedition as archæologist. From St. John's, Newfoundland, to Labrador, the trip will be made in the ship Kite, which was formerly used by Mr. Peary. At St. John's, Newfoundland, this party will be joined by ten scientists sent out to explore the coast of Elsemere's Land and will consist of a number of scientists, including Dr. T. C. Mendenhall, Superintendent of United States Coast Survey, General A. W. Greely, J. W. Powell, Director of the United States Geological Survey, Baron Adolf Erie Nordenskjold, of the Royal Academy of Science, Sweden, Baron von Baurmajeltsch, J. A. W. Grip, Envoy Extraordinary from Germany to Norway and Sweden. These persons are sent out to explore the coast of Elsemere's Land and also to discover traces of the ancestors of the Greenlanders, who, it is thought, came from that place. Professor Hite, of the University of Pennsylvania, is the originator of the expedition.

### An Exhibition at Innsbruck.

Arrangements are now being perfected for the International Exposition for Physical Education, Hygiene, and Sport, which will be held in the town of Innsbruck, Austria, from May to October, 1896. The exposition will include exhibits from all the trades and industries pertaining to the physical education of the growing child and to the sports of the adult as well. In the first group will be shown objects which relate to the nutrition, care, and physical training of children from their birth to the age when schooling begins. The second group will be devoted to gymnastics, swimming, fencing, boats, sporting costumes, etc. In the third group are all kinds of outdoor and indoor games, and the fourth group will be devoted to skating and children's games, showing skates, sleighs, snowshoes, roller skates, and toboggans. In group fifth will be found exhibits which pertain to riding and driving, and besides models, plans, and representations of stables, all kinds of stable equipments will be shown and models for racecourses will also be exhibited. The sixth group is of particular interest, as it is devoted to cycling, and it is reported that there will be an international contest between the manufacturers in all parts of the world. The commission appointed for the United States includes many well known men who are interested in sporting affairs.

### The Care of the Aged.

When a man or woman passes seventy years of age, great care should be given to the conditions surrounding him or her for the prolonging of life. The vital forces are greatly enfeebled at that period of life, and the powers of resistance in consequence of age are the weakest. A man of threescore years and ten, and over, is like an old machine that by proper care given to its condition has been kept running many years, and is still able to do work, but its wheels and axles and pinions are much worn and are rickety, and if it should be pushed, even to a small extent, in excess of its diminished powers, it breaks down and cannot be repaired, for every part of it is shattered. But if worked carefully and intelligently by a person who understands its condition and knows its capabilities, it can be kept in action a much longer time than would be possible if a careless engineer controlled it. In these fast times, however, it is generally not profitable to husband the resources of an old machine. But this is not true as regards our old men and women. It is desirable to hold on to them as long as possible, and if we can succeed in prolonging their lives five or ten years, or more, it will greatly enhance our happiness.—Medical Review.

### Why and How Thread is Numbered.

The question, "Why is spool cotton numbered as it is, and why are the figures not used in regular order?" is often asked, says the Boston Journal of Commerce. The explanation is this: The numbers on the spools express the number of "hanks" which are required to wind a pound. The very finest spinning rarely exceeds 300 hanks to the pound, while in the very coarsest there is about a half pound in each hank. The more common qualities, however, those from which sewing thread is usually made, run from ten to fifty hanks to the pound, and the spools on which it is wound are numbered from 10 to 50 in accordance.

PROF. RAOULT, of Grenoble, has received the biennial prize of $4,000 from the Académie des Sciences for his discovery of the numerical ratio between the molecular weight of a substance and the difference produced on the freezing point of the liquid that dissolves it, as well as on the expansion of the vapors of the liquid.

### Science Notes.

Botanic Gardens.—The Berlin paper Kuhlow's says: "Of botanic gardens France has 22, Germany 35, Great Britain and Ireland 11, the Indian empire 9, Italy 22, Russia 14, New Zealand 3, the United States 5. It is said that the finest botanical gardens in the world are situated in the islands of the Azores. When Portugal was at its prime in the great office of discovering the world, a rage for botanical specimens was current among all interested in the maritime adventures of those interesting days. The climate of the Azores lends itself particularly to the growth of the products of almost every land. The result is a series of magnificent botanical gardens in those summer islands, where may be seen nearly every tree and plant known to the early navigators."

The latent life of seeds has been investigated by M. C. De Candolle, and he has come to the conclusion that in their latent life seeds pass through a period of suspended animation (vie ralentie) in which all the functions of the protoplasm are quiescent, but from which they revive when again placed in conditions suitable for germination. This period of suspended animation may extend over an indefinite time, probably through a long series of years, and the seeds may during this period be subjected to a very low temperature without losing their vitality. In the case of wheat, oat, and fennel, the temperature was reduced as low as minus 30 degrees C., and the experiment was repeated as many as one hundred and eighteen times on the same seeds without injurious effects; the greater number of the seeds of the sensitive plant, however, succumbed to this temperature, and nearly all those of Lobelia crinus. The immunity from injury appears to depend on the protoplasm of the seed passing into a completely inert state, incapable of either respiring or assimilating before it is placed under the unfavorable conditions.—Gardeners' Magazine.

Prof. Mark W. Harrington, late Chief of the United States Weather Bureau, and who is now president of the University of Washington, intends to establish a department of terrestrial physics and geography in the university.

Prof. Sollas, F.R.S., will leave England shortly for Sydney, Australia, to take charge of an expedition to make deep borings in a coral atoll. The Royal Society contributes about $4,000 to the expense fund and the British government has placed a gunboat at the disposal of the party. The scene of operations will be Funifuti, in the Central Pacific.

Dr. Kruegger, of Charlottenburg, Germany, finds that the combustion of acetylene is improved by being mixed with an equal volume of carbon dioxide. The consumption is about 0·053 cubic foot of each gas per amyl-acetate unit, or say 0·06 cubic foot per candle.

A writer in the Popular Science Monthly has noted that on the basis of an average salinity of 3½ per cent in the 200,700,000 cubic miles of water which make up the oceans there are 90,000,000,000,000,000 tons of salt, equivalent to 10,173,000 cubic miles of salt. This is sufficient to cover the land of the earth to a depth of 1,000 feet.

MM. Troost and Ouvrard, in the Comptes Rendus, state that if an electric current be passed through a mixture of nitrogen, argon and helium in which there is a sufficient quantity of fine magnesium wire in a Plücker's tube, the following phenomenon is noticed: When the temperature rises and the magnesium begins to volatilize, the argon and helium are absorbed and a nearly complete vacuum results.

Prof. Roentgen, of Würzburg, after a lecture which he had delivered on his new X ray photography, was invested with the Order of the Crown (Kronen Orden), second class.

Austria has decided to combine with Germany in an expedition to the South Pole, and Julius von Payer, the explorer of Franz Josef Land, has been asked to give up his expedition to northeast Greenland in order to take the command of it.

The air is clear at Arequipa, Peru. From the observatory at that place, 8,050 feet above the sea, a black spot, one inch in diameter, placed on a white disk, has been seen on Mount Charchani, a distance of eleven miles, through a thirteen inch telescope.

It is announced that no fewer than four small planets were discovered on the night of January 7, two by M. Charlois, of Nice, and two by Dr. Max Wolf, of Heidelberg. If all four are duly verified, the total number will be raised to 413. Perrine's comet may be seen now in the morning, but its brightness as compared with unity on November 18 is greatly reduced. Dr. Lamp's ephemeris for Berlin mignight on February 1 reads R. A. 19h. 40m. 50s., S. Dec. 4° 41·6', brightness 0·29. The comet does not appear to have been observed in the southern hemisphere.

Aluminum for Cooking Utensils.—A scientific investigation was recently undertaken by the Imperial German Health Bureau to inquire into the suitability of the use of aluminum for cooking utensils. They proved that aluminum is entirely free from communicating to food any poisonous salt, such as is given off by copper, tin, or lead. To make sure that no injurious effects need be feared if aluminum be taken into the system, two physicians, aged respectively twenty-six and thirty-five, volunteered to act as subjects. To each of these was administered daily with their lunch about fifteen grains of aluminum tartrate, for the period of one month. By the end of that time neither had lost flesh or appetite, nor felt the slightest discomfort. For cooking purposes, this metal seems to be peculiarly adapted, as it is a splendid conductor of heat, while it has also the advantage of being non-poisonous and non-corroding.

In addition to his other achievements in the domain of chemistry, Dr. Deninger, of Dresden, is now reported to have prepared carbon monosulphide, CS, pure for the first time, and finds that, instead of being, as described in the text books, an amorphous red solid, it is really a colorless gas. He prepared it by heating dry sulphide of sodium with chloroform, or, preferably, iodoform, in sealed tubes, to 180° C., the gaseous products being made to bubble through aqueous caustic potash, which absorbed the sulphureted hydrogen, and the carbon monosulphide passed through unabsorbed. By acting upon carbon disulphide with sodium, in the presence of some aniline, the new gas was also obtained. It is colorless and easily condensable to a clear liquid, which evaporates rapidly, and is extremely explosive.

Sir John Lubbock describes an ant which can support a weight three thousand times heavier than itself, or equal in proportion to a man holding 210 tons by his teeth.

### Motor Carriages in Great Britain.

A recent conviction for the illegal use of a horseless carriage has been obtained in England. The owners of the carriage were summoned for not carrying a flag in front of it. The defense contended that the prosecution was an absurdity. A fine of one shilling and costs was imposed.

At a very early date an "International Horse and Horseless Carriage and Roads Locomotion Exhibition" will be held within the great Crystal Palace building at Sydenham, London. From the present condition of things, automobile carriages cannot be run in England on public highways, and in order that no delay should occur from this fact, the extensive grounds of the Crystal Palace, which is situated within five miles of the center of the metropolis, are to be utilized for trials and races of self-propelled vehicles. The exhibition will be comprehensive in its scope and will be of great scientific interest. It will be divided into two sections. In the first will be things appertaining to animal locomotion, such, for example, as the primitive modes of transportation employed in former times, the ancient sledges, litters, palanquins, and other wheelless conveyances which will gradually lead up to an interesting display of antique and mediæval coaches and carriages. Modern coaching as well will not be neglected. Turning to the engineering section, many of the interesting steam-driven carriages which ran upon English roads some sixty years ago are to be shown in connection with the steam, electric, and petroleum driven carriages of to-day. Accessories of various kinds for horseless carriages will also be exhibited. Mr. A. R. Sennett, A.M.I.C.E., has accepted the post of honorary executive commissioner.

### Gas from Sawdust.

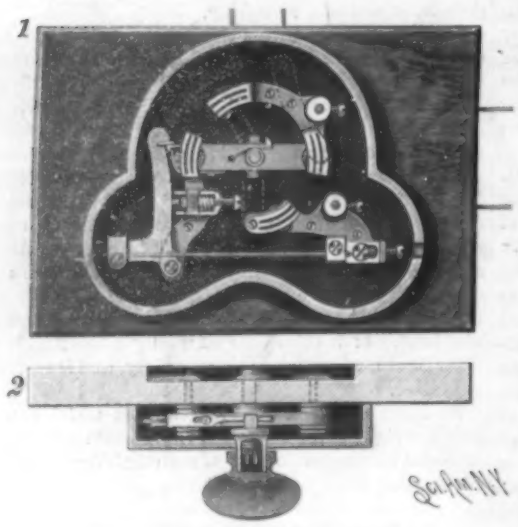
There are several large lumber mills in Deseronto, Canada, and the town is partially lighted by gas obtained from sawdust from them. The sawdust is charged in retorts which are heated by a wood fire. The gas from these retorts passes into a series of coils and thence into the purifiers, which are similar to those used for coal gas. Lime is used as a purifying agent. The plant is not a very large one, and it only turns out 540 cubic meters of gas per day, for which about two tons of sawdust are required. A man and boy furnish all the labor needed at the works. The best quality of gas comes from resinous woods. One hundred kilogrammes of sawdust leave a residue of twenty kilogrammes of charcoal, and the gas in an ordinary burner, says the Engineering and Mining Journal, gives an illumination of about eighteen candle power.

TO MAKE ALUMINUM IN NORWAY.—The estate of Hafslund, near the great waterfall known as the Sarpsfos, between here and Goteborg, has been acquired by a syndicate, chiefly consisting of German and American capitalists. The purchasers intend to form a large company with a large capital in order to utilize the water power of the falls for electrical force, and establishing aluminum works on the same principle as those now being constructed at the Falls of Foyers, in Scotland. The Sarpsfos is one of the finest falls in southeastern Norway, being 74 feet in heigh and 116 feet in width.

A MONUMENT to Francois Garnier, the explorer, whose murder at Hanoi ultimately brought about the Tonkin expedition and the French policy of colonial expansion, is to be set up midway between the Observatoire and the Luxembourg Palace in Paris. The sculptor is M. Puech.

### AN IMPROVED ELECTRIC SWITCH.

The illustration represents a simple and effective switch which may be used as an ordinary switch and also as a cut-out for preventing the passage of an excessive current to a particular portion of the circuit. The improvement has been patented by Henry B. Whitehead, of No. 57 Madison Street, Memphis, Tenn.




WHITEHEAD'S ELECTRIC SWITCH.

Fig. 1 represents a vertical and Fig. 2 a horizontal section of the switch, whose base is of insulating material, recessed at the back to receive the electrical connections, while a cover fits over the working parts. On a stud projecting from the base is fulcrumed a spring-actuated switch arm adapted to be engaged by a detent lever, while a spring tends to disengage the detent lever from the arm. An expansion wire, used as a conductor, is arranged to normally hold the detent lever in engagement with the switch arm, but releases the lever when the wire is expanded by heat due to excessive current. A key, having a fork loosely embracing the lever, has a thumbpiece outside the cover, whereby the switch arm may be released from the detent lever and turned by hand.

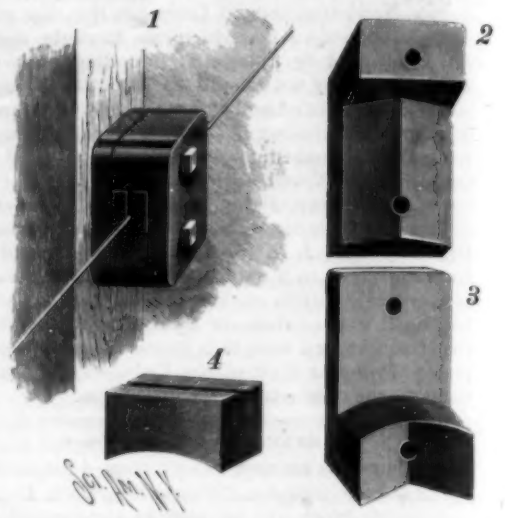
### Keep Your Mouth Shut.

The Family Doctor says that this is the secret of avoiding colds. The man or woman who comes out of an overheated room, especially late at night, and breathes through the mouth, will either catch a bad cold or irritate the lungs sufficiently to cause annoyance and unpleasantness. If people would just keep their mouths shut and breathe through their noses, this difficulty and danger would be avoided. Chills are often the result of people talking freely while out of doors just after leaving a room full of hot air, and theatergoers who discuss and laugh over the play on their way home are inviting illness. It is, in fact, during youth that the greater number of mankind contract habits or inflammation which make their whole life a tissue of disorders.

IT is stated that a "Fine Arts and Industrial Exhibition" will be held at Barcelona, beginning on the 23d of April next. An international exhibition will also be held in Brussels in 1897.

### AN INSULATOR FOR ELECTRIC WIRES.

To prevent the humming noise caused by the vibrations of electric wires when they are fastened to poles or other supports, the insulator shown in the illustration has been devised and patented by Magin Riera, of Apartado 649, Havana, Cuba. Fig. 1 represents the insulator as attached to a support in use, Figs. 2 and 3 showing its clamping pieces, and Fig. 4 its central elastic insulating portion. The contacting surfaces of the clamping members are concaved and convexed respectively, or have a wedge-shaped projection and a corresponding recess, and they inclose between them an elastic filling slotted to about its center to receive the wire, the clamping pieces causing the split portion of the filling piece to closely hug the wire.




RIERA'S INSULATOR.

### A PORTABLE DISINFECTING PLANT.*

BY W. H. FRANCIS, PHILADELPHIA, PA. (M.A.S.M.E.)

In military science it is an axiom to defeat and destroy an army in detail; this is equally applicable to fighting contagious disease, and is attracting marked attention from sanitarians. It is not the province of the mechanic to discuss or pass upon the microbe theory, calling for disinfecting machines, but to apply practically, for everyday use, the facts which bacteriologists and doctors have proved to be true.

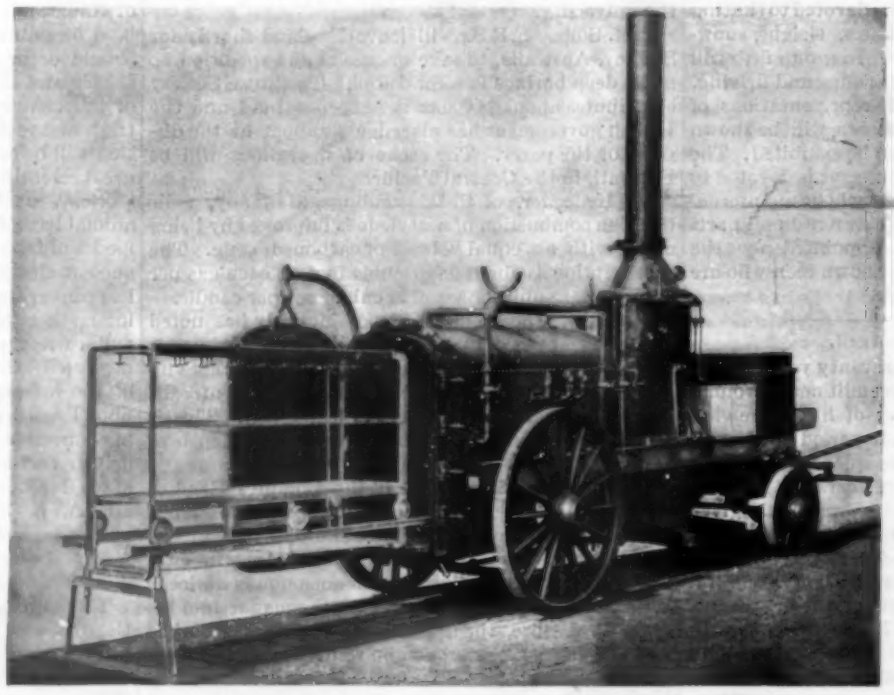
At the December meeting of 1893 was presented a paper on "A Modern Disinfecting Plant," as applied to quarantine stations, to prevent contagion reaching our shores. Supplemental to this article a brief description is now offered of a portable disinfecting plant for destroying epidemic disease in detail, upon its first appearance in our cities. These machines are the outgrowth of a study of the epidemic of yellow fever at Brunswick, Georgia, and the indifferent means the doctors had to improvise to aid them in the fight, although, it is true, these were the best that could be obtained at the time in a city cut off by strict quarantine. For instance, a box car on one of the railroads was hastily transformed into a steam chamber, steam being provided by the locomotive, and infected articles carried long distances to and from the car. It is greatly to the doctors' credit that with such means they were able to check the ravages of the fever.

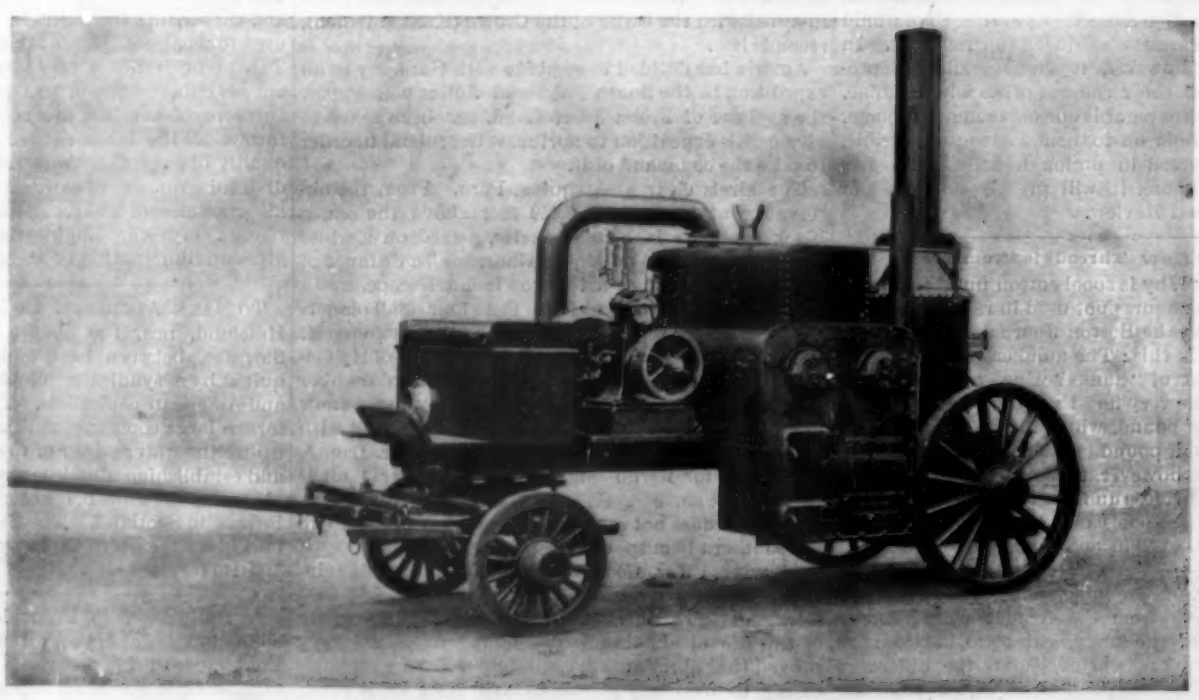
* Presented at the Detroit meeting of the American Society of Mechanical Engineers, and forming part of volume xvi of the Transactions.

The portable plant comprises two machines:

First, the steam disinfector, consisting (as seen by examining the upper cut) of a jacketed chamber, car, boiler, and vacuum pump, mounted upon a suitable running gear. Its operation is as follows:

The steam generated in the boiler at high pressure is reduced by proper valve, circulating in the jacket at low pressure during the entire operation. The infected clothes are placed upon screens, or hung on hooks in the car, which is supported by a portable track, adjustable for irregularities of roadway, the car then being pushed into chamber, and the door, swinging on crane, closed and bolted, made steamtight by a rubber gasket. A thermometer records the temperature, and when the clothes have reached that of the low pressure steam the vacuum pump is started, removing the air (the object of which is twofold, to prevent possibility of life to the microbe and to give steam greater penetrating effect), after which the steam is admitted to the chamber from the jacket, insuring circulation. The incoming steam strikes upon a three-leaf hood, to prevent being forced directly upon the clothes, and any condensation is carried down the sides of the chamber, preventing wetting and consequent shrinkage of woolens. The exposure is continued for varying time, according to the character of the infected articles, after which the steam in the chamber is discharged through a valve, the door opened, and the car withdrawn.





A PORTABLE DISINFECTING PLANT.

The car is arranged with removable trays and is open-sided, so as to hold either single or double mattresses, wooden guards of cypress being introduced to prevent them from projecting beyond the sides of the car.

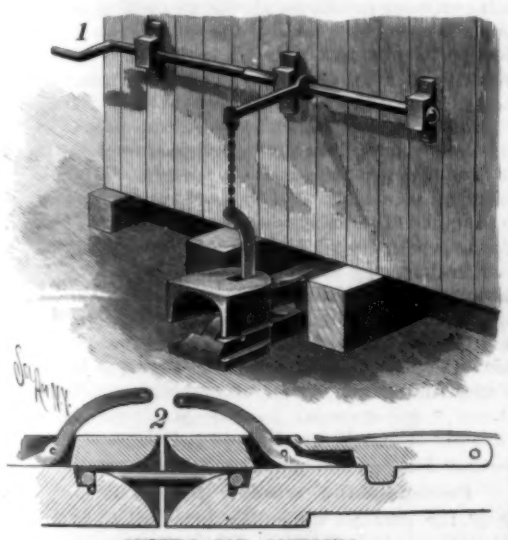
Second, the sulphur fumigator, consisting of a furnace, boiler, engine, and fan, mounted on wheels, as seen in the lower cut. The sulphur furnace is double, with a firebox at

one end, the sulphur being held in a cast iron pan, under slow combustion, to produce the dioxide; and to continue the operation without opening the doors and causing rapid combustion, a double-winged stoker is provided by which additional roll sulphur can be introduced to the pan. The fumes travel through the double furnace to a reservoir on top, provided with baffle plates, and are then sucked by exhaust fan (driven direct by a rapid-speed engine), thence through hose into the building being fumigated, the quantity being regulated by a sliding gate valve. Both these machines embody the same principles described in previous paper, and are intended, in case of infection appearing in a certain quarter, to be driven to the infected house, and after the patient's removal, all bedding, clothing, etc., be disinfected in the steam disinfector, after which the house itself be thoroughly disinfected by the sulphur fumigator.

These machines were designed for the United States Marine Hospital Service by Dr. Walter Wyman, Supervising Surgeon-General, in association with Dr. J. J. Kinyoun, one of the able bacteriologists in the bureau.

### AN IMPROVED CAR COUPLING.

The engraving represents a coupler adapted to automatically couple cars as they come together, the uncoupling being readily effected by means of a releasing attachment from the side of the car. Fig. 1 is an end view of a car body on which the improvement is applied, Fig. 2 being a sectional side view of two of the couplings in coupled connection. The drawhead and drawbar are formed in two hinged portions, and the lower or main section has centrally at its forward end a latch hook, there being at each side of the hook a level portion or seat on which the coupling link rests. The upper section of the coupling fits in an open recess




SMITH'S CAR COUPLING.

in the lower section, and has at its front end parallel depending flanges embracing the side walls of the drawhead portion of the lower section. In the bottom of the latch hook recess is a groove in which is a lifter bar whose ends are secured in the flanges of the upper section, the latter being held normally depressed by a plate spring, and the insertion of the link, as it passes over the coupling hook, lifts the upper section against the tension of the spring, which holds the inserted link in level position, with the lifter bar below its inner end. To release the link in uncoupling, a curved lever is pivoted in a longitudinal slot in the upper section, the toe of the lever having a bearing on the lower section, while its other end is connected by a chain with a transverse shaft on the end of the car. The shaft has a crank handle at the side of the car, and by moving the crank the upper section and the lifter bar are raised to release the link from engagement with the coupling hook. To hold the upper section and lifter bar in raised position, the transverse shaft is formed with a squared portion adapted to interlock with a square locking box, on pushing the shaft endwise, the link being then held in uncoupled adjustment for withdrawal. This improvement has been patented by John F. Smith, of Burbank, Ohio. It will be observed that, in cars equipped therewith, the coupling link may be easily placed to couple automatically with an approaching car, and that the trainmen do not have to go between the cars in uncoupling them.

### A NEW RECORDING THERMOMETER FOR ATMOSPHERIC RANGES OF TEMPERATURE.

The novel and especially valuable feature of the recording thermometer herein described is that the recording portion may be located at a distance of twenty-five or thirty feet from the point at which the temperature is to be measured.

This makes it possible to obtain a continuous record of the outside temperature while the recorder is located at a convenient point within doors where it may be readily observed and its mechanism is not exposed to the detrimental influences of inclement weather. For cold storage plants where closed rooms are to be maintained at a constant temperature for the preservation of meats, fruits, and vegetables, an instrument of this kind is of great value, as the temperature may be observed without opening the doors.

The recording part (Fig. 1) is an application of one of Bristol's recording pressure gages. Fig. 3 shows an interior view of the recorder, which consists of a pen arm directly attached to the free end of a tube of flattened cross section bent into helical form.

The bulb portion (Fig. 2) is placed at the point where temperature is to be measured. It consists of a series of helical tubes constructed on the same principle as that in the recorder. The helical coils are suspended in a vertical position with their lower ends free, the upper ends opening into the capillary tube connecting them with the recorder.

The system of helical tubes forming the bulb portion, the pressure tube of the recorder and the capillary connecting tube are completely filled with alcohol under pressure and permanently sealed. As the temperature rises and falls where the bulb is located, there is a corresponding expansion or contraction of the alcohol which is communicated to the recorder and registered on a seven day chart graduated to read in degrees Fahrenheit.

Excessive pressures due to increased volume of the non-compressible liquid are provided against by the expansible form of the system of helical tubes of which the bulb is constructed. The total volume of the bulb portion is very large as compared with that in the pressure recorder, thus avoiding the necessity of compensating for ordinary changes of temperature in the room where the recorder is located. No correction is required for barometric changes, as only high ranges of pressure are employed.

This thermometer is being manufactured by the Bristol Company, of Waterbury, Conn. One of the instruments may be seen in operation recording the outside temperature at their New York branch office at 121 Liberty Street. The recorder is placed in the show window, where it may be observed from the sidewalk.

FORWARD'S MECHANISM FOR PROPELLING BOATS.

### MECHANISM FOR PROPELLING SMALL BOATS.

A means of propelling small boats which enables the boatman to sit facing the bow, instead of looking rearward, as in rowing, is illustrated in the engraving, and has been patented by Walter Forward, of San Diego, Cal. The short propeller shaft in the rear of the boat has a wide pulley connected by two belts with three pulleys on a driving shaft, one of the belts being a crossed belt and the other a straight belt, and the center pulley being an idler. The driving shaft carries a fly wheel on the hub of which is a sprocket wheel, or a grooved wheel with pins in its groove, and an apertured belt engaging this wheel passes under a double pulley in the bottom of the boat, and forward, under the seat, around a similar wheel upon a shaft journaled in front of the boatman's seat. In front of the seat are parallel slideways, in each of which slides a block having a foot rest, and the blocks are each connected by a pitman with a crank on the driving wheel. By means of a belt shifter connected by a rod with a hand lever in convenient reach of the boatman, the belts connecting the drive shaft with the propeller shaft may be shifted so that the latter will be operated by either the straight or the crossed belt, to propel the boat forward or to back it, the driving shaft being continuously revolved in one direction by the alternate forward movement of the feet of the boatman pressing against the foot rests or pedals on the slide blocks. To facilitate adjusting the seat in the most convenient position forward or rearward, it is mounted on a racked or toothed support, the seat having a corresponding toothed portion for engage-

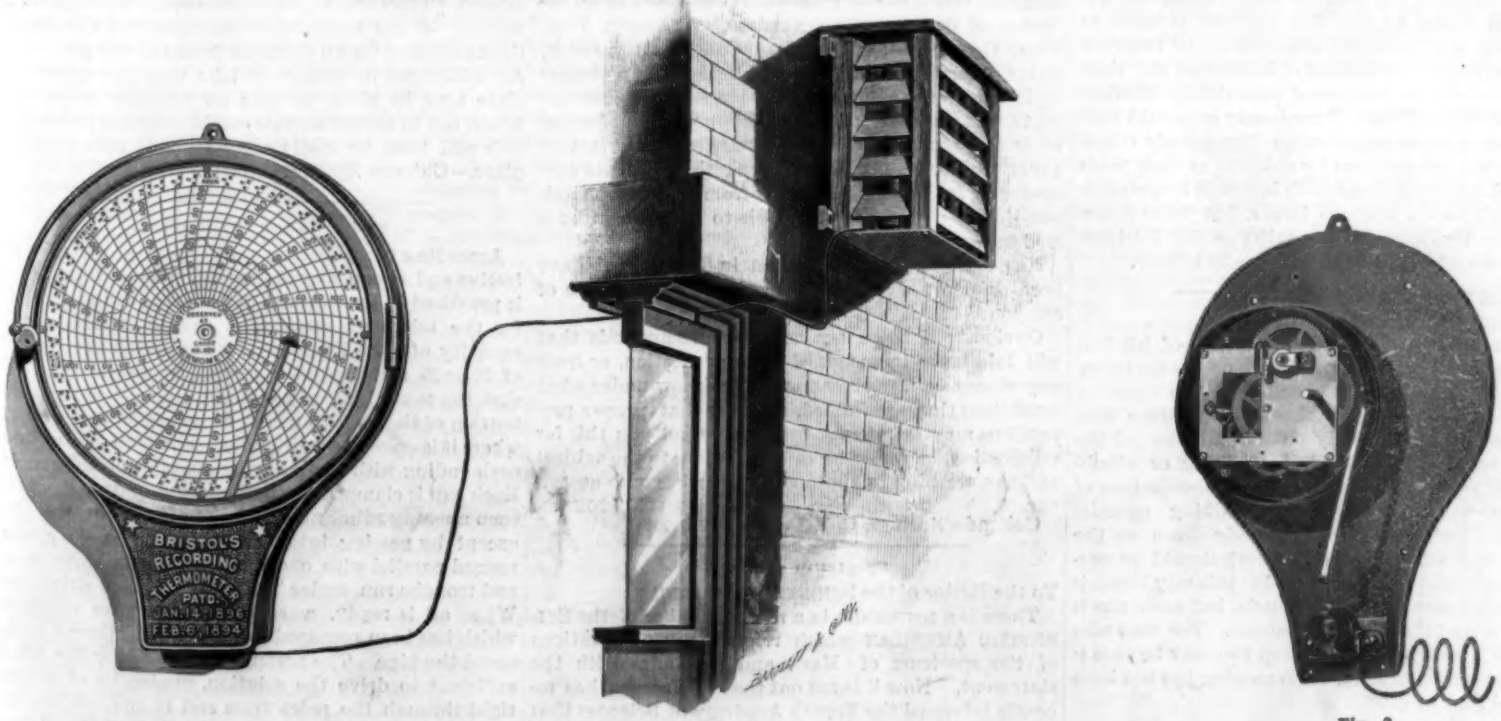



Fig. 1. Fig. 2. Fig. 3.

A THERMOMETER FOR MAKING AN INTERIOR RECORD OF THE OUTSIDE TEMPERATURE.

ment therewith. There are no ratchets or other mechanism to make a noise, and the boat is especially adapted for hunting purposes, enabling the boatman to quietly approach a desired point.

### The Modified Milk Question.*

I have lately had opportunity for studying the remarkable work that has been done in Dresden in preparing a perfect substitute for breast milk.

The superiority of the Dresden modification rests mainly upon the recognition of an essential difference between casein and lactalbumen. Professor Lehmann's analyses of breast milk and cow's milk show that while cow's milk is more than twice as rich in casein, it is much poorer than human milk in lactalbumen, as may be seen in the following tables:

| | Cow's milk. | Human milk. |
|---|---|---|
| Casein | 3·0 per cent. | 1·2 per cent. |
| Albumen | 0·3 " | 0·5 " |
| Fat | 3·5 " | 3·8 " |
| Sugar | 4·5 " | 6·0 " |
| Ash | 0·7 " | 0·2 " |
| Water | 88·0 " | 88·3 " |
| | 100·0 | 100·0 |

If, therefore, cow's milk be diluted with water sufficiently to reduce the casein of the mixture to the amount found in human milk, the mixture will contain only one-third enough lactalbumen.

Furthermore, if the milk be sterilized, still further loss is occasioned, as the coagulated albumen is wasted in the scum and by clinging to the sides of the bottle.

We know the disadvantages of too much casein. We rightly dread the cheese curds in the dejections, for such undigested lumps not only show that the infant has not received the needed albuminous nourishment, but has had its intestine irritated by these foreign masses. But if we dilute the cow's milk sufficiently to avoid these cheese curds, we shall be starving the baby, unless we add some soluble albumen.

Three forms of soluble albumen are available: peptonized grain albumen, meat juice, and the white of egg. The last is undoubtedly the best, because of closest resemblance to lactalbumen and of easiest attainment.

THE DRESDEN METHOD.

To the white of one fresh egg slowly add 13 drachms (32 grammes) of milk sugar and vigorously stir, taking care not to beat air into the mixture, for egg foam will not mix well with water. To this paste slowly add a pint and a half of water, stirring constantly. This emulsion is then strained through fine linen into a pint of milk. Slight stirring or shaking completes the mixture.

The milk should be 3½ per cent richness in fat. The cheap lactometer gives a fairly accurate measurement. When the source of supply is not known to be unquestionable, it is probably better to sterilize the milk. The fresh egg partly compensates for the deadness of sterilized milk. Scurvy is becoming more prevalent in children fed wholly on sterilized milk. The milk sugar ought also to be sterilized in a seal jar if we wish the mixture to keep good for months. Vessels, strainers and cover cloths also sterilized.

It is a common mistake to add lime water or soda to modified cow's milk. Although to litmus cow's milk appears to be acid, it really is not so. The litmus test is deceptive in estimating the acidity or alkalinity of phosphate solutions. Lime water added to an infant's food overtaxes the stomach by wasting just so much gastric juice as is needed to offset the alkali. When the infant's digestion is weak, dilute hydrochloric acid added to the milk mixture is right in theory and of marvelous advantage in actual practice.

Again, as regards the custom of increasing the richness of the infant's food or of prescribing different qualities for different ages, it needs only to be said that it is as nonsensical as to prescribe increasingly richer beef and bread and potatoes for children as their years increase. A mother's breast milk increases in quantity as her baby's stomach grows larger, but there is certainly no such change in its quality as the intricate tables of our text books would lead us to believe.

### How to Walk Upstairs.

Usually a person will tread on the ball of his foot in taking each step, springing himself up the next step. This is very tiresome and wearing on the muscles, says Public Opinion, as it throws the entire suspended weight of the body on the muscles of the legs and feet. You should, in walking or climbing stairs, seek for the most equal distribution of the body's weight possible. In walking upstairs your feet should be placed squarely down on the step, heel and all, and then the work should be performed slowly and deliberately. In this way there is no strain upon any particular muscle, but each one is doing its duty in a natural manner. The man who goes upstairs with a springing step you may be sure is no philosopher, or, at least, his reasoning has not been directed to that subject.

*By A. Worcester, A.M., M.D., Waltham, Mass., in Boston Med. and Surg. Journal.

## Correspondence.

### Roentgen Photography.

To the Editor of the SCIENTIFIC AMERICAN:

In repeating the experiments of Mr. Crumbie, described in the Electrical World, I obtained a negative with several images of each of the coins and keys used.

Feeling satisfied that the objects could not have moved while under the influence of the current, I exposed a plate to the action of several keys and coins, but without use of the induction coil or any exterior current whatever.

Now while I have seen numerous accounts of the results obtained by use of metallic objects inside the closed dry plate holder, with the aid of the electric current, I have failed to note any account of the same effect being obtained without the current, or a Crookes tube, or electric lamp, or something external.

Is it possible that the effect of metals on the dry plate has not been noted?

This effect, let it well be understood, is similar to the Roentgen effect, not a reduction under the metal, but the reverse, the reduction taking place around the objects, the film under the objects remaining unchanged and washing out in the hypo, giving the "shadows."

A coin and a piece of cardboard when placed together on the dry plate both gave shadows. Great care was taken to prevent access of light, and the plate and holder remained in the dark room during the whole experiment, thoroughly shielded from light.

If this matter has not been brought to the attention of the public, I would be glad if you will use the data I have sent you. F. W. TRAPHAGEN.

Montana College of Agriculture and Mechanic Arts, Bozeman, Mont., February 22, 1896.

[The images of the keys and coins in the photographs received from Prof. Traphagen are as clear and distinct as those in any of the radiographs we have published.—ED.]

### The Recent Acetylene Explosion.

To the Editor of the SCIENTIFIC AMERICAN:

The recent explosion at a factory in Connecticut, in which it is said experiments were being made with acetylene, reminds me of an acetylene experiment which I once made unexpectedly. It was in 1880. I was cutting off a small piece from a ball of metallic potassium (under naphtha as usual), when a violent explosion followed. The thick glass bottle was blown to pieces and thirty of the pieces penetrated my hand, some going almost through it. The potassium was soft as usual, and there was only a gentle pressure of the knife. The knife was dry and there was no water in or near the bottle. If there was a flash accompanying the explosion, it could not have been very bright. The lecture room was instantly filled with a dense smoke, consisting in part of potassium oxide or hydrate, but mostly of dark fumes from the naphtha, which appeared to have been all vaporized or decomposed; at least it all disappeared from the place of explosion and there was no flame following. The explosion was very sharp and sudden, after the order of the fulminates, and shook a large building. That the explosion was confined to one of the potassium balls was proved by the fact that the other potassium balls that had been in the bottle were much flattened, but were still so far distinguishable they could be counted.

I immediately made inquiries from a number of chemists, but none of them had ever heard of an explosion of dry metallic potassium. At length Prof. Henry Carmichael, of Bowdoin College, Brunswick, Maine, informed me that he had heard of two similar explosions in Germany, and that German chemists had found that it was due to an acetylene compound formed while the potassium was in process of manufacture under hydrocarbons. In general, the chemists succeeded in freeing the potassium from this compound, but if they did not, it was liable to explode under a moderate pressure.

May not the recent explosion in Connecticut have been due to the same compound or a similar class of compounds?

Obviously if there are acetylene compounds that will fulminate by means of a jar or friction, or from any other cause, it is important to know under what conditions they are formed, in order that proper precautions may be taken. I therefore send you this for publication, in order to call attention to the subject and as a warning to those experimenting with acetylene. GEORGE H. STONE.

Colorado Springs, Col., February 15, 1896.

### Spectrum of Mars.

To the Editor of the SCIENTIFIC AMERICAN:

There is a paragraph in a recent number of the SCIENTIFIC AMERICAN which refers to my observations of the spectrum of Mars, and concludes with the statement, "Now it turns out that M. Janssen has recently informed the French Academy of Sciences that he has determined the existence of water vapor in the planet Mars by means of the spectroscope."

I fear your note has been very misleading to many of your readers. M. Janssen's observations, to the results of which you refer, were made on Mount Etna in the year 1867, about twenty-nine years ago, and he communicated his results to the French Academy of Sciences in the year 1867, as follows: ". . . I believe I can announce to you the presence of aqueous vapor in the atmospheres of Mars and Saturn." (See Comptes Rendus for 1867, vol. lxiv, p. 1304.)

Further, in my original paper on "The Spectrum of Mars," I called attention to M. Janssen's observations, quoting his results in full. I reviewed all the observations of Mars' spectrum, including M. Janssen's, in the Astrophysical Journal for June, 1895; and in that article I requested that we be given the details of his 1867 observations. In response, M. Janssen published some of the details of his 1867 observations in the Comptes Rendus for July 29, 1895, evidently the publication to which your note refers.

M. Janssen stated that his observations were made May 12 to 15, 1867. Perhaps we may say that at that time the diameter of Mars was less than 6 seconds of arc; that is, about one-fourth the diameter of the planet at a favorable opposition. We are not informed as to the apparatus which was carried up Mount Etna for making the observations, but the telescope was probably comparable with a 6-inch refractor. In brightness and width the spectrum would not be very unlike that of a bright star.

The question of Mars' atmosphere and its constituents has an intensely popular side and an intensely unpopular side. It happens that my observations led me to a middle ground conclusion; but since they did not prove the existence of an atmosphere and water on Mars, they are generally misunderstood to favor the absolute non-existence of those elements. Such, however, is not the case. So far as I know, every astronomer has always held that the planet has some atmosphere. The polar caps are satisfactory evidence on that point. My conclusion was that the Martian atmosphere is not sufficiently extensive to have been detected by the spectroscopic observations thus far made. It may be detected at some future time—I hope it will. If it is, I am confident that it will prove to be not more than one-fourth as extensive as our terrestrial atmosphere: that is, its density at the surface of the planet will not be more than about half the density of the atmosphere at the summit of the Himalaya Mountains. At least such is the conclusion which I drew from my observations when they were made.

At the opposition of Mars next winter I trust that valuable results will be obtained by a photographic study of the spectrum. It is quite possible that photographic methods will reveal traces of aqueous bands in the spectrum which visual observations could not detect. W. W. CAMPBELL.

Lick Observatory, Mount Hamilton, Cal.

### Photographing Window Displays.

One of the greatest difficulties attached to photographing a window display is the reflection in the plate glass front of the buildings on the opposite side of the street and of the passing throng. Many trimmers will thank us for indicating a successful way in which their efforts may be taken by the camera without this annoying feature. If the artist will provide himself with a black curtain, mounted at each end on wooden poles, nothing more will be needed. It must be of sufficient size to screen the largest window, and a center aperture must be cut in order to insert the camera. This curtain, when held in place by assistants, will cut off the undesirable reflection and still admit light sufficient for all purposes from the top and sides. An additional advantage will be that the sensitized plate may be given as long an exposure as desired. When not in use the curtain can be rolled on the standards and thus be easily carried about from place to place.—Chicago Apparel Gazette.

### Swiss Wood Preserving.

According to an English contemporary, a simple, effective and cheap way of preserving wood from decay is practiced in Switzerland in the preparation of posts for the telegraph service. A square tank, having a capacity of some 200 gallons, is supported at a height of 20 or 25 feet above the ground by means of a light skeleton tower built of wood. A pipe drops from the bottom of the tank to within 30 inches of the ground, where it is connected with a cluster of flexible branches, each ending with a cap having an orifice in the center. Each cap is clamped on to the larger end of a pole in such a manner that no liquid can escape from the pipe except by passing into the wood. The poles are arranged parallel with one another, sloping downward, and troughs run under both ends to catch drippings. When all is ready, a solution of copper sulphate, which has been prepared in the tank, is allowed to descend the pipe. The pressure produced by the fall is sufficient to drive the solution, gradually, of course, right through the poles from end to end. When the operation is ended and the posts dried, all the fiber of the wood is permeated with the preserving chemical.

## THE MANUFACTURE OF THE HAMMOND TYPEWRITER.

(Continued from first page.)

through, and slides freely within, a horizontal slot, which is cut through the anvil and provides an accurate horizontal guide for the shuttle.

A shuttle arm, B, is provided, which is pivoted upon the same central shaft as the anvil, and by means of a vertically projecting pin at its outer end engages the above mentioned shuttle web. The inner end of the shuttle arm extends beyond the anvil wheel and slides freely upon a circular frame, which is perforated with as many holes as there are vertical lines of type in the shuttle; the relative distance between these holes corresponding, with the very greatest accuracy, with the horizontal distance between the separate type on the type shuttle. Working vertically in these holes are a series of index pins, C, which are held down upon the keybars, D, by spiral springs. Returning to the shuttle arm, B, it will be seen that, just to the rear of the pin upon which it rotates, it is provided with two slots, one on each side, which are engaged by two vertical arms which receive their motion from the key bar, D, through the arm, F. The action of the machine is as follows:

The depression of the bar, D, raises the corresponding index pin, C, and also lifts the arm, F, which drives the above mentioned vertical arm forward and thereby turns the shuttle arm, B, round until it is arrested by said pin, C. The proper letter on the shuttle is now in position for the impression, and the further depression of the bar, D, raises the lever, E. The further end of this lever depresses the piece, G, which actuates a pawl and ratchet arrangement for releasing the impression hammer. The hammer is impelled by a coiled spring against a rubber impression strip, which presses the paper against the type on the shuttle. The tension of this spring, and, consequently, the force of the blow, is regulated by a suitable screw. Upon releasing the key bar, D, all the parts return automatically to their normal positions.

It will be seen that the perfect alignment of this machine is dependent upon the absolute level of the horizontal slot, which serves to guide the shuttle web—upon the exact location of the hole in the web which is engaged by the shuttle arm—and upon the true relation of the letters on the type shuttle to the index pins which serve to arrest the shuttle at the proper place for impression.

The peculiar type of the Hammond machine, and the great accuracy aimed at, have necessitated the establishment of a special plant, which possesses features of great interest. The desired type (which is of great variety, including many of the foreign alphabets) is first engraved upon a steel wheel (Fig. 5). As the location of the type on the wheel is a matter of the greatest nicety, a special tool, shown in Fig. 1, has been designed for the purpose.

This consists of a circular plate (Fig. 1) upon which is arranged a central raised disk, provided with an arm which reaches to the outer periphery of the plate, the disk with its arm rotating concentrically upon the plate (Fig. 1) at its periphery. The plate is perforated with holes corresponding to the index holes in the typewriter, and the arm is provided with a pin, by which it can be held in a position corresponding to the letter whose place on the steel wheel is to be marked. The wheel is placed on the center disk, and as the projecting arm is shifted to the successive holes, the operator marks with a scriber the position of the type on the wheel. The accuracy of this machine is said to be gaged to $\frac{1}{1000}$ of an inch.

A type metal matrix is then formed from the engraved wheel. The segments of this matrix are arranged around the inner circumference of a circular mould, and strips of a special composition of rubber are forced into them. The thin strip of steel, which forms the shuttle web, is pressed into the rubber, and the moulds are then clamped up and placed in the vulcanizers (Fig. 3), where they are subjected to a heat equivalent to a pressure of 100 pounds to the square inch. The vulcanizer consists of a steamtight drum, provided with a detachable cover. Water is placed in the drum, together with the articles to be vulcanized, and the desired heat is obtained by a Bunsen burner as shown. When this process is complete the vulcanite shuttle, with its thin steel web in place, is taken out and placed in the same machine (Fig. 1) in which the steel wheel was engraved, for the purpose of stamping out the hole, shown in Fig. 6, by which it is engaged by the shuttle arm, B. This, again, is a matter of the greatest nicety, as the slightest variation of this hole to the right or left of its proper position relative to the type would throw every letter out of truth. This relative position is found by means of a die and plunger. The plunger is a permanent fixture upon the bottom plate, and points to the center of the plate. The shuttle is placed on the raised disk upon which the steel wheel was previously cut, and turned around until the plunger is opposite the letter I of the type. This brings the steel web into its proper position beneath a punch, which cuts the desired hole. It will thus be seen that the all-important matter of the location of this hole is rendered very exact.

This great accuracy of manufacture, combined with the fact that the type is successively presented for impression at a common point and from a common center, and that the impression blow is delivered by one and the same hammer and with a constant momentum, secures that perfect alignment and evenness of print for which this machine is justly celebrated.

To change one type shuttle for another, the anvil is raised until the type shuttle web clears the end of the shuttle arm, when the web of the shuttle can be drawn forward out of the groove in the anvil and another shuttle put in place. As each shuttle contains a complete alphabet, the variations that are possible are very numerous. The Hammond Company show a specimen of work in thirty-seven styles of type and in fourteen languages.

An interesting feature of the machine is the fact that, if a customer should require some letter on the shuttle changed, a shuttle is cast with a raised blank in place of the particular letter, and the new character is engraved thereon.

The Hammond machine is furnished with either the "Ideal Keyboard," which is the type recommended by the makers, or, if preferred, with the "Universal Keyboard," in which the keys are arranged as in other well known machines. In the Ideal Keyboard, as shown in the attached cut, the keys are arranged in circular form, in two banks, the letters most frequently in use being arranged under the right hand and near the center of the board.

To enable the operator to see his work the circular frame surrounding the anvil, which holds the type-shield, J, and the ribbon, is arranged so that it can be temporarily depressed, rerurning to position again on being released. In this way the work is kept in sight, and the lifting of the body of the machine is avoided.

In cut No. 5 is shown another form of shuttle. It is in two segments, and each segment carries one-half of the type. The two right and left vertical lever arms each engage one of the segments. This was the earlier form, the single shuttle being a later development. The total weight of the machine with its traveling case is nineteen pounds.

## AN IMPROVED MUSIC LEAF TURNER.

According to the invention illustrated in the engraving, the box or casing containing the mechanism by which the leaves of music may be readily turned is adapted to be placed upon a piano or other instrument, the leaf-turning arms before commencing to play being adjusted between the sheets, as shown in Fig. 1, when the leaves may be turned in succession by touching the lever at one side. The improvement has been patented by P. H. Adams, of Osorno, Chile. The casing has a cover at one end only, and the leaf-turning arms are fulcrumed side by side on a cross rod, resting, when not in use, upon the open end of the casing. Attached to each arm above its pivot is a cord which passes over a pulley at the end of the casing and is then connected to a spring, the springs normally holding the arms in their lower or horizontal position. In the covered end of the casing is a shaft which carries a drum or cylinder, and on the end of the shaft is a pointer which moves over a dial plate, to indicate the number of leaves that have been turned over. Arranged spirally upon the cylinder, as shown in Fig. 2, is a series of pins, and in each end of the cylinder are openings corresponding in number and position with the pins, the right hand end of each opening being straight and its left hand end inclined or tapering. A lever mounted loosely on the shaft has an angular spring catch adapted to enter the openings, the catch, as the lever is pressed downward, engaging the shoulder of an opening and turning the cylinder the distance between two teeth, the lever, when released, being returned by a spring to its normal position, and carrying the catch backward to engage with the next hole. Locking arms or latch bars, adapted to be engaged by the pins of the cylinder, are fulcrumed in such relative position to the music leaf-turning arms that when the latter are elevated they press down the inner ends of the locking arms, maintaining the leaf-turning arms in vertical position, but as the cylinder is turned, on touching the lever, a pin lifts the rear end of a locking arm to release the leaf-turning arm, which is then, under its spring tension, carried to one side with the leaf of music, passing across the face of the sheet, smoothing it out and holding it in its turned position. Each time that the cylinder is turned to turn a sheet it is indicated on the dial, the shaft rotating with a step-by-step movement corresponding to the distance apart of the pins.

ADAMS' MUSIC LEAF TURNER.

## Emery.

Emery is one of the few valuable rocks not yet produced in important quantities in America. Large amounts are yearly brought from Turkey and the Greek Islands, where it has been quarried since history began. Its wonderful properties were no secret to the ancients, who used it for cutting and polishing; but their methods of working are not certainly known. Curiously, modern methods of mining this substance have made no progress, and to this day ledges of emery have been heated by huge fires and the hot rock cracked by douches of cold water.

During the middle ages, and for many years afterward, the properties of emery, while not forgotten, could not be utilized. The old art of working was lost, and ingenuity was unable to give useful forms to this intractable substance. It long defied every effort. Slowly, however, emery again came into use, first as a polishing and cutting powder, and later, in the form of small grains, was attached to fabrics like a sandpaper. Means were afterward found to cement and mould its small particles into wheels. Emery wheels soon came into use, their remarkable cutting properties proving at once the great industrial importance of the invention.

Years elapsed, however, before the emery millstone could be made; but, at length, this too was accomplished, and a practical emery stone was brought out in England. Later, Yankee ingenuity improved upon this and produced the present successful rock emery millstone, which is built up of large blocks of emery set in strong metal.

These millstones grind fast because the emery face is always sharp, and as they are not damaged by heat, they can be run at high speed.

Many new uses will doubtless be found for emery; but probably it can take no more important place than that of the emery wheel and the emery millstone, the one cutting and polishing in the shops the hardest surfaces and the other grinding the surface to any degree of fineness.

## Leather Belt Cross Section Needed.

This useful table shows what area of cross section of leather belt is needed to give various horse powers, with various arcs of contact on cast iron pulleys, at a belt speed of 3,000 feet per minute, the fastenings being single leather lacings.

From it, having decided on the thickness, the width may be determined, or vice versa, by simple division.

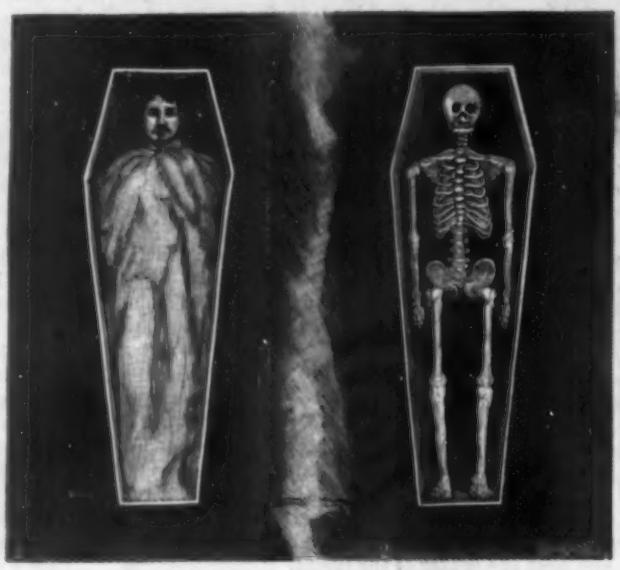
| ARC. | HORSE POWERS. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| Degrees. | Sq. in. | Sq. in. | Sq. in. | Sq. in. | Sq. in. | Sq. in. | Sq. in. | Sq. in. | Sq. in. | Sq. in. |
| 30 | 0·90 | 1·79 | 2·68 | 3·58 | 4·48 | 5·37 | 6·27 | 7·16 | 8·06 | 8·95 |
| 45 | 0·63 | 1·26 | 1·88 | 2·51 | 3·14 | 3·77 | 4·40 | 5·02 | 5·65 | 6·28 |
| 60 | 0·49 | 0·99 | 1·48 | 1·98 | 2·47 | 2·96 | 3·46 | 3·95 | 4·45 | 4·94 |
| 75 | 0·41 | 0·83 | 1·24 | 1·64 | 2·07 | 2·40 | 2·90 | 3·28 | 3·73 | 4·14 |
| 90 | 0·36 | 0·73 | 1·09 | 1·45 | 1·82 | 2·17 | 2·55 | 2·91 | 3·26 | 3·64 |
| 105 | 0·33 | 0·65 | 0·98 | 1·31 | 1·63 | 1·96 | 2·29 | 2·61 | 2·94 | 3·27 |
| 120 | 0·30 | 0·60 | 0·90 | 1·20 | 1·50 | 1·80 | 2·10 | 2·40 | 2·70 | 2·99 |
| 135 | 0·28 | 0·56 | 0·83 | 1·11 | 1·39 | 1·67 | 1·94 | 2·23 | 2·50 | 2·78 |
| 150 | 0·26 | 0·52 | 0·78 | 1·04 | 1·30 | 1·56 | 1·82 | 2·09 | 2·35 | 2·61 |
| 165 | 0·25 | 0·50 | 0·75 | 0·99 | 1·24 | 1·49 | 1·74 | 1·99 | 2·24 | 2·49 |
| 180 | 0·24 | 0·47 | 0·71 | 0·95 | 1·19 | 1·42 | 1·66 | 1·90 | 2·13 | 2·37 |
| 195 | 0·23 | 0·46 | 0·68 | 0·91 | 1·14 | 1·37 | 1·60 | 1·83 | 2·05 | 2·28 |
| 210 | 0·22 | 0·44 | 0·66 | 0·88 | 1·10 | 1·32 | 1·54 | 1·76 | 1·98 | 2·20 |
| 240 | 0·21 | 0·42 | 0·62 | 0·84 | 1·05 | 1·25 | 1·46 | 1·68 | 1·87 | 2·09 |
| 270 | 0·20 | 0·40 | 0·60 | 0·80 | 0·99 | 1·20 | 1·40 | 1·60 | 1·80 | 1·99 |
| 300 | 0·19 | 0·39 | 0·58 | 0·77 | 0·97 | 1·16 | 1·35 | 1·54 | 1·74 | 1·93 |

## THE CABARET DU NEANT.

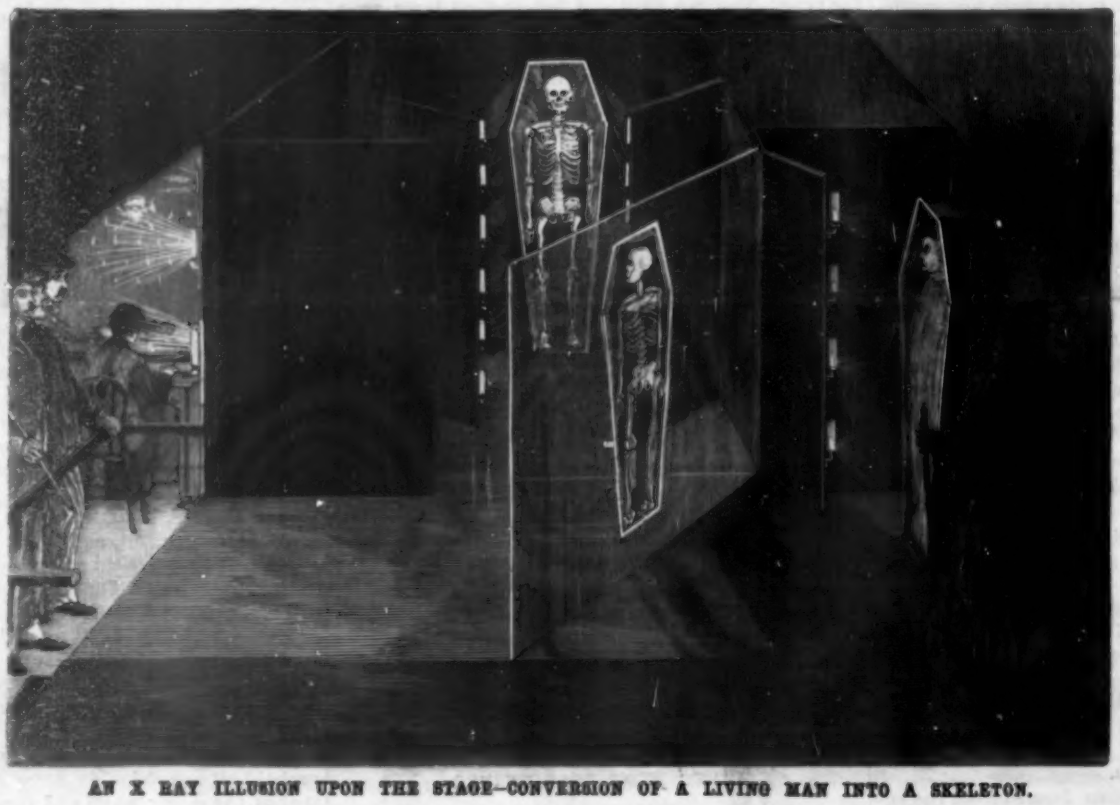
A most interesting performance, based upon the principles of the well known "Pepper's ghost," is now on exhibition in this city, with sundry somewhat fantastic accessories and developments justifying the title of "The Cabaret du Neant," or "Tavern of the Dead" ("non-existing"), which has been given to it by its proprietors. It is a recent importation from Paris. While the principal interest of the exhibition centers in the ghost effects, which we illustrate, a word or two may be said of the sequence of acts.

The spectators pass through a long hall hung with black and find themselves in a spectral restaurant. Along the walls coffins are placed for tables, and on the end of each coffin is a burning candle. From the center of the ceiling hangs a what is termed "Robert Macaire's chandelier," made to all appearances of bones and skulls. The spectators are here at liberty to seat themselves at the tables and are served with what they desire by a mournful waiter dressed like a mute with long crape hanging from his hat. Around the walls of the room are placed pictures to which the spectator's attention is called by the lecturer. Seen by the light of the room these pictures are ordinary scenes, but a new aspect is given to each when lights directly behind it are turned on; the figures in it appear as skeletons, each picture being in fact a transparency giving a different effect as it is lighted from the rear or as seen simply by reflected light. The second chamber is now entered; it is hung with black throughout. On the walls tears are painted, and in close juxtaposition are two somewhat incongruous inscriptions, "Requiescat in pace," and "No smoking." The reason for the latter admonition, which is also given by the lecturer, is that for the success of the illusion an absolutely clear atmosphere is essential. At the end of this second chamber, at the back of a stage, is seen a coffin standing upright, in which one of the audience is requested to place himself. Entering the stage by the side door, he is conducted by an attendant to the coffin and placed in it. Blocks of wood are placed for him to stand on in quantity sufficient to bring his head to the right height so that the top of it just presses against the top of the coffin, and the attendant with great care adjusts his height according to the predetermined position. Two rows of Argand burners illuminate his figure, which is then wrapped in a white sheet. Now, as the spectators watch him, he gradually dissolves or fades away and in his place appears a skeleton in the coffin. Again, at the word of command the skeleton in its turn slowly disappears, and the draped figure of the spectator appears again. The illusion is perfect to the outer audience; the one in the coffin sees absolutely nothing out of the common. His interest, if he knows what is going on, is centered in watching the changing expression of the spectators, being increased by the fact that at their period of greatest astonishment he is absolutely invisible, although directly before them and seeing them more plainly than ever. After the restoration to life one or more auditors are put through the same performance, so that the recent occupant of the coffin can see what he has gone through.

The third chamber is now entered, somewhat similar to the second, but on its stage is a table and seat, all the walls being lined with black. One of the auditors is invited to seat himself at the table on the stage. He does it, and, as before, sees nothing. While the description of the lecturer and the appearance and comments of the audience tell him that something very interesting is going on, the remarks will probably disclose to him the fact that this time at least he is never out of their sight. He leaves the stage and his place is taken by another, and then he understands the nature of the drama in which he has been an unconscious participator. He sees the other spectator seated alone at the table. Suddenly a spirit, perhaps of an old man, appears at the other side of the table, while a bottle and glass, are seen upon the table. When exhorted to help himself to the liquid, the performing spectator's idle gestures show that he certainly does not see the glass, through which his hand passes unobstructed. Or perhaps it is a woman who appears and makes the most alluring gestures toward him who never sees her. This concludes the exhibition which as accessory has the strains of a funeral march, the ringing of deep sounding bells as room after room is entered, and the appearance of a brown robed Charon to introduce the spectator to his place in the coffin. In one of our illustrations we show, side by side, the coffin with its living occupant draped in a sheet and in the other the skeleton which appears in his place. Two other cuts show the scenes between the spectator at the table and the specters, illustrating how active a part the specters take, they being no mere painted appearances, but evidently living, moving things. Our large illustration shows precisely how it is done and so clearly that an explanation is hardly needed. The floor of the stage is represented. To the left are seen the spectators and the performer at the piano discoursing his lugubrious melodies. To the right is seen Charon, and directly in front of him the coffin with its living occupant. When lighted up by the burners shown near him, the other burners being turned down, the coffin with its occupant is all that is seen by the spectator. Directly in front of the coffin, crossing the stage obliquely, is a large sheet of the clearest plate glass, which offers no impediment to the view of the coffin with its occupant, when the latter is fully illuminated. At one side of the stage, in the back of the picture, is a painting of a skeleton in a coffin with its own set of Argand burners. It is screened from view. When strongly illuminated, and when the lights of the real coffin are turned down, the spectators see reflected from the glass a brilliant image of the pictured coffin and skeleton. By turning up one set of burners as the others are turned down a perfect dissolving effect is obtained, skeleton replacing spectator and vice versa at the will of the exhibitor.



THE SUBJECT AND HIS SKELETON.



AN X RAY ILLUSION UPON THE STAGE—CONVERSION OF A LIVING MAN INTO A SKELETON.

The magic lantern operator always realizes that to secure a good dissolving effect perfect registration is essential. In the securing of this lies the secret of the coffin exhibit of the Cabaret du Neant. By the blocks on which the occupant of the coffin stands, and by the adjustment of his head by the attendant, the head is brought into perfect registration with the reflected head of the skeleton. The wrapping with the sheet, presumably the enveloping in a shroud, is done with a purpose. It covers the body from the shoulders down and extends to the very bottom of the coffin, covering the blocks also, thus doing away with all defects of registration which would be incurred in the persons of spectators of different heights. In other words, the exhibition fits out everybody with a skeleton of precisely the same height, however tall or short he may be, the draping of the sheet and accurate position of the head concealing from the spectators this inaccuracy, the skull occupying precisely the place of the head, the rest taking care of itself.

Still referring to the large cut, it will be seen that it serves to explain the exhibition in the other chamber. Instead of the coffin there is the table and chair, and in place of the pictured

THE SHEETED GHOST.

THE FEMALE SPIRIT.

skeleton a live performer is placed. In this act there is no dissolving effect; by turning up the lights at the side of the stage any object desired and performers dressed as spirits are made to appear upon the stage, being reflected from the glass plate. The spectators simultaneously see their companion sitting at the table and the reflections of the ghosts apparently executing their movements about him.

From the scientific as well as scenic aspect, the exhibition is most interesting, and to one who knows how it is performed, the interest is vastly enhanced. To properly enjoy it, the stage position should be taken during one or both performances.

The Roentgen rays are utilized in the advertising matter also, although John Henry Pepper, of the old London Polytechnic, may lay some claim to discovering the full utilization of the rays actually used in the Cabaret du Neant.

### A MINER'S TOOL AND CANDLESTICK.

For holding a miner's candle in place on his cap, or for attaching the candle to the walls of a mine, the device shown in the accompanying illustration has been devised, the same implement being also adapted to cut fuse, crimp cartridges and tamp blasts. The improvement has been patented by Adolph O. Sjoholm, of Negaunee, Mich. The device has a nearly circular handle, on a screw-threaded projection of which is mounted the cartridge crimper and fuse cutter, the rotative member of which lies clamped in folded position when not required for use. A sharpened point projects from one side adapted to be inserted in a crevice of the wall or in a timber to hold the candle, a thumb nut then locking the device in the desired position. A screw-theaded sleeve on the body of the device supports a hook adapted to be inserted in the miner's cap or hat, and the hook is held in position by engagement with a bent spring metal band which forms a socket to receive the candle. In the opposite end of the handle is a socket piece adapted to receive and hold a pin or peg of wood or other soft material to be used for tamping charges, the peg being swung back into the handle when not required for use. The whole device may be folded to take up but little space, when it may be conveniently carried in the pocket.

SJOHOLM'S MINER'S TOOL AND CANDLESTICK.

### PRACTICAL EXPERIMENTS FOR THE DEVELOPMENT OF HUMAN FLIGHT.

BY OTTO LILIENTHAL.

Whoever has followed with attention the technical treatises on flying will have become convinced that human flight cannot be brought about by one single invention, but is proceeding toward its perfection by a gradual development; for only those trials have met with success which correspond with such a development. Formerly men sought to construct flying machines in a complete form, at once capable of solving the problem, but gradually the conviction came that our physical and technical knowledge and our practical experiences were by far insufficient to overcome a mechanical task of such magnitude without more preliminaries.

Those proceeding on this basis therefore applied themselves, not to the problem of flying as a whole, but rather divided it into its elements, and sought first to bring a clear understanding into said elements which should form the basis of final success. For example, take the laws of atmospheric resistance, upon which all flying depends, and regarding which, until very recent years, the greatest uncertainty has existed; these have now been defined to such an extent that the different phases of flight can be treated mathematically. Besides which, the physical processes of natural flight of the creatures have become the subject of minute investigation, and have in most cases been satisfactorily explained. The nature of the wind, also, and its influence on flying bodies, have been carefully studied, thus enabling us to understand several peculiarities of the birds' flight hitherto unexplainable, so that one can apply the results thus obtained in perfecting human flight.

The theoretical apparatus needed for the technics of flying has been enriched so much by all these studies within the last few years that the elements of flying apparatus can now be calculated and constructed with sufficient accuracy. By means of this theoretical knowledge one is enabled to form and construct wing and sailing surfaces according as the intended effect renders it desirable.

But, with all this, we are not yet capable of constructing and using complete flying machines which answer all requirements. Being desirous of furthering with all speed the solution of the problem of flight, men have repeatedly formed projects in these last few years which represent complete air ships moved by dynamos; but the constructors are not aware of the difficulties which await us as soon as we approach the realizing of any ideas in flying.

From a raised starting point, particularly from the top of a flat hill, one can, after some practice, soar through the air, reaching the earth only after having gone a great distance.

For this purpose I have hitherto employed a sailing apparatus very like the outspread pinions of a soaring bird. It consists of a wooden frame covered with shirting (cotton twill). The frame is taken hold of by the hands, the arms resting between cushions, thus supporting the body. The legs remain free for running and jumping. The steering in the air is brought about by changing the center of gravity. This apparatus I had constructed with supporting surfaces of ten to twenty square meters. The larger sailing surfaces move in an incline of one to eight, so that one is enabled to fly eight times as far as the starting hill is high. The steering is facilitated by the rudder, which is firmly fastened behind in a horizontal and vertical position. The machines weigh, according to their size, from fifteen to twenty-five kilogrammes (thirty-three to fifty-five lbs.) In order to practice flying with these sailing surfaces one first takes short jumps on a somewhat inclined surface till he has accustomed himself to be borne by the air. Finally he is able to sail over inclined surfaces as far as he wishes. The supporting capacity of the air is felt, particularly if there is a

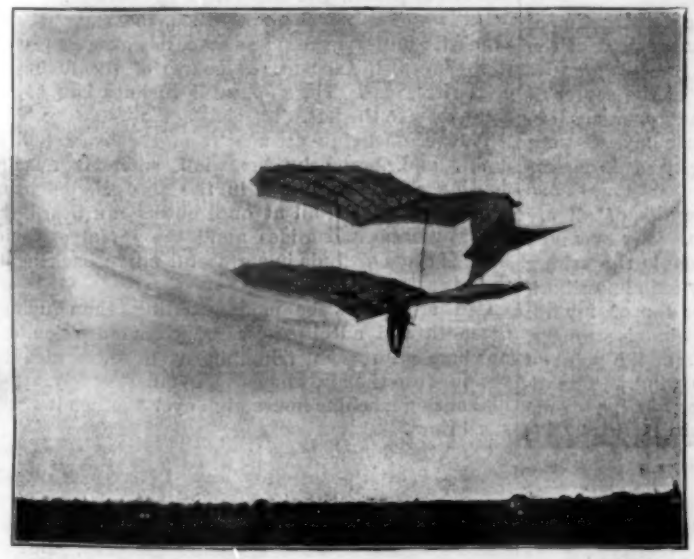


Fig. 1.

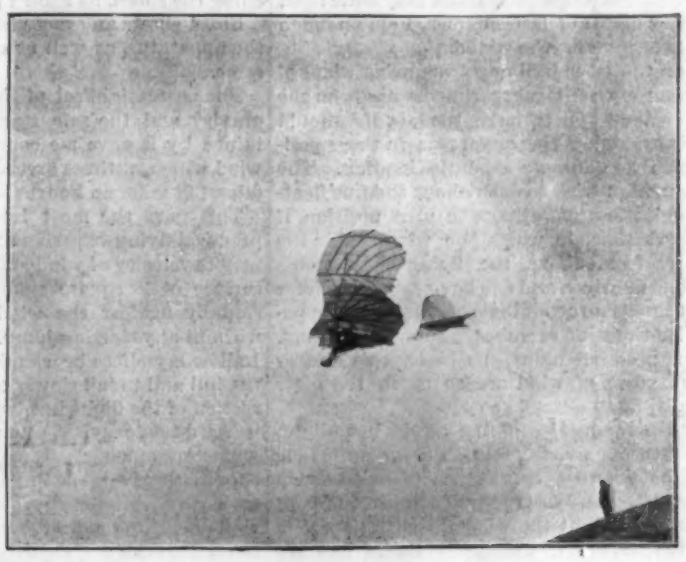


Fig. 2.

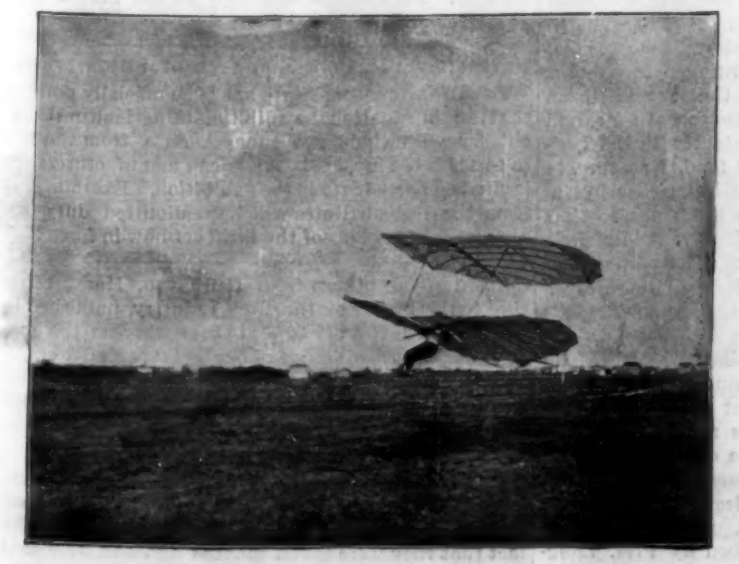


Fig. 3.

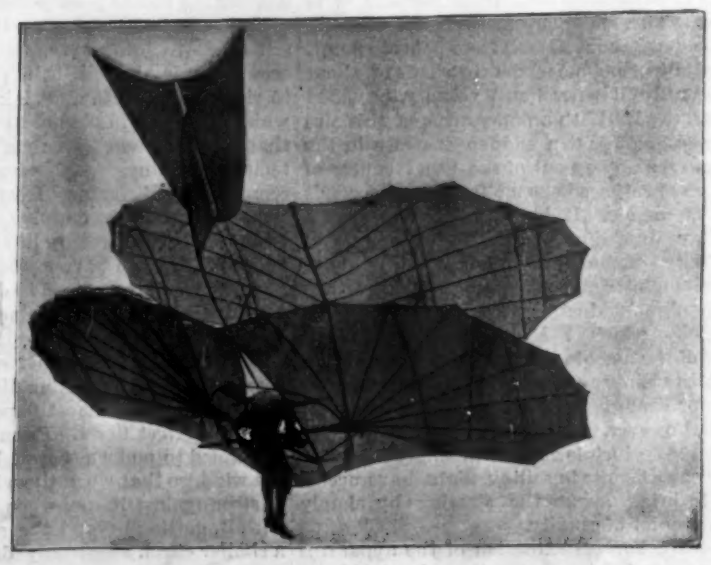


Fig. 4.

OTTO LILIENTHAL'S LATEST FLYING MACHINE.

breeze. A sudden increase in the wind causes a longer stoppage in the air, or one is raised to a still higher point. The charm of such flight is indescribable, and there could not be a healthier motion or more exciting sport in the open air.

The apparatus which I now employ for my flying exercises contains a great many improvements as compared with the first sailing surfaces with which I commenced this kind of experiment five years ago. The first attempts in windy weather taught me that suitable steering surfaces would be needed to enable me to keep my course better against the wind. Repeated changes in the construction led to a kind of apparatus with which one can throw himself without danger from any height, reaching the earth safely after a long distance. The construction of the machine is such that it resembles in all its parts a strut frame, the joints of which are calculated to stand pull and pressure, in order to combine the greatest strength with the least weight.

An important improvement was to arrange the apparatus for folding. All of my recent machines are so arranged that they can be taken through a door two meters high. The unfolding and putting together of the flying implements takes about two minutes. A single grip of the hands is sufficient to attach the apparatus safely to the body, and one gets out of the apparatus just as quickly on landing. In case of a storm the flying sail is folded up in half a minute and can be laid by anywhere. If one should not care to fold the apparatus, he may await the end of the storm under cover of the wings, which are capable of protecting twenty persons. Even the heaviest rain will not damage the apparatus. The flying apparatus, even if completely drenched, is soon dried by a few sailing flights after the rain stops, as the air passes through the same with great speed. The latest improvements of the flying apparatus which I use for practical experiments refer to gaining of greater stability in windy weather.

My experiments tend particularly in two directions. On the one side I endeavor to carry my experiments in sailing through the air with immovable wings to this extent: I practice the overcoming of the wind in order to penetrate, if possible, into the secret of continued soaring flight. On the other hand, I try to attain the dynamic flight by means of flapping the wings, which are introduced as a simple addition to my sailing flights. The mechanical contrivances necessary for the latter, which can reach a certain perfection only by gradual development, do not allow yet of my making known any definite results. But I may state that, since my sailing flights of last summer, I am on much more intimate terms with the wind.

What has prevented me till now from using winds of any strength for my sailing experiments has been the danger of a violent fall through the air, if I should not succeed in retaining the apparatus in those positions by which one insures a gentle landing. The wildly rushing wind tries to dash about the free floating body, and if the apparatus take up a position, if only for a short time, in which the wind strikes the flying surfaces from above, the flying body shoots downward like an arrow, and can be smashed to pieces before one succeeds in attaining a more favorable position in which the wind exercises a supporting effect. The stronger the wind blows, the easier this danger occurs, as the gusts of wind are so much the more irregular and violent.

As long as the commotion of the air is but slight, one does not require much practice to go quite long distances without danger. But the practice with strong winds is interesting and instructive, because one is at times supported quite by the wind alone. The size of the apparatus, however, unhappily limits us. We may not span the sailing surfaces beyond a certain measure, if we do not wish to make it impossible to manage them in gusty weather. If the surfaces of 14 square meters (about 150 square feet) do not measure more than 7 meters (about 23 feet) from point to point, we can eventually overcome moderate winds of about 7 meters (about 22 miles per hour) velocity, provided one is well practiced. With an apparatus of this size it has happened to me that a sudden increase in the wind has taken me way up out of the usual course of flying, and has sometimes kept me for several seconds at one point of the air. It has happened in such a case that I have been lifted vertically by a gust of wind from the top of the hill, floating for a time above the same at a height of about 5 meters, whence I then continued my flight against the wind.

The means by which I sought to facilitate the management of the machines and to increase their use in wind consisted in the first place in different arrangements for changing the shape of the wings at will. I will, however, pass over the results here obtained, as another principle gave surprisingly favorable results. My experiments in sailing flight have accustomed me to bring about the steering by simply changing the center of gravity.

The smaller the surface extension of the apparatus is, the better control I have over it, and yet if I employ smaller bearing surfaces in stronger winds, the results are not more favorable. The idea therefore occurred to me to apply two smaller surfaces, one above the other, which both have a lifting effect when sailing through the air. Thus the same result must follow which would be gained by a single surface of twice the bearing capacity, but on account of its small dimensions this apparatus obeys much better the changes of the center of gravity.

Before I proceeded to construct these double sailing machines, I made small models in paper after that system, in order to study the free movements in the air of such flying bodies and then to construct my apparatus on a large scale, depending on the results thus obtained.

I need only recall the extensive and expensive experiments made by Messrs. Riedinger, Von Sigsfeld, and Von Parsefal, of Augsburg, which showed the difficulty of constructing models that would automatically take up a course of stable flight. I myself doubted formerly very much that an inanimate body sailing quickly forward could be well balanced in the air, and was all the better pleased in succeeding in this with my little double surfaces. Relying on this experience I constructed first a double apparatus in which each surface contains 9 square meters (about 97 square feet). I thus produced a comparatively large bearing surface of 18 square meters with but 5½ meters (about 18 feet) span. The upper surface is separated from the lower by a distance equal to three-quarters of the breadth of the lower surface, and it has no disturbing influence whatever, but creates only a vertically acting lifting force. One must consider that with such an apparatus one always cuts the air quickly, so that both surfaces are met by the air current, and therefore both act as lifters.

The whole management of such an apparatus is just the same as that of a single sailing surface. I could, therefore, use at once the skill I had already obtained.

I had to change the center of gravity, and particularly the position of the legs, to the left, in order to press down the left wing, which is a little raised. In Fig. 1 the opposite movement to the right is shown. I retain the middle position whenever the apparatus floats horizontally.

The flights undertaken with such double sailing surfaces are distinguished by their great height, as is shown in Fig. 2, which gives a side view of the apparatus.

The landing with this apparatus is brought about in the same way as with the single sailing surfaces by raising the apparatus in front somewhat and by lessening the speed, as shown in Fig. 3.

Fig. 4 shows an exact picture of the construction of the apparatus, as well as of the management of the same.

The energetic effect of the change of the center of gravity and the safe starting of the apparatus obtained by it gave me courage to trust myself to a wind which at times exceeded a velocity of 10 meters (about 24 miles an hour).

This gave the most interesting results of all my practical flying experiments hitherto. Six or seven meters velocity of wind sufficed to enable the sailing surface of 18 square meters to carry me almost horizontally against the wind from the top of my hill without any starting jump. If the wind is stronger, I allow myself to be simply lifted from the point of the hill and to sail slowly toward the wind. The direction of the flight has, with a strong wind, a strong upward tendency. I often reach positions in the air which are much higher than my starting point. At the climax of such a line of flight I sometimes come to a standstill for some time, so that I am enabled while floating to speak with the gentlemen who wish to photograph me, regarding the best position for the photographing.*

At such times I feel plainly that I would remain floating if I leaned a little toward one side, described a circle and proceeded with the wind. The wind itself tends to bring this motion about, for my chief occupation in air consists in preventing a turn either to right or the left, and I know that the hill from which I started lies behind and underneath me, and that I might come into rough contact with it if I attempted circling. My endeavors tend, therefore, to remove myself farther from the hill either by increased wind or by flapping with the wings, so that I can follow the strongly lifting air current in a circle and so that I can have a sufficient space of air under and beside me to succeed in describing with safety a circling flight and to land finally steering against the wind.

As soon as I or any other experimenter succeeds in describing the first circling flight, one may regard this event as one of the most important conquests on the road to perfect flight. From this moment only, one is enabled to make a thorough use of the vis viva of the wind, so that when the wind increases one is able to steer against it, and when it decreases one can fly with it, getting beyond the same. One will feel here a similar effect, as already described by Prof. Langley in his celebrated treatise entitled "The Internal Work of the Wind." It is no easy step from the theoretical conviction to the practical execution. The dexterity required to allow one's self to be borne by the wind alone, by describing well directed circles, is only understood by those who are well acquainted with the difficulties one encounters with the wind. And yet all that may be acquired by practice. When the time comes that athletic associations emulate each other, such results will not be long in following.

Moreover, experimenters will proceed from simple floating and sailing, which in any case form the foundation for practical flight, by degrees to flying with movable implements. As one is enabled to balance himself for some time in the air, the foundations for more extended dynamic effects are easily and safely attained. The different projects may be easily tried by adding the motor work to the simple sailing flight taken as a basis. In this manner one will soon find out the best methods; for practical experience in the air is far better than figuring on paper.

The only thing which may cause difficulties is the procuring of a suitable place for practicing. Just as the starting from the earth is rather difficult for larger birds, the human body, being still heavier, meets with peculiar difficulties at the first flight upward. The larger birds take a running start against the wind or throw themselves into the air from elevated points, in order to obtain free use of their pinions. As soon, however, as they float in the air, their flight, which was begun under special difficulties, is easily continued. The case is similar in human flight. The principal difficulty is the launching into the air, and that will always necessitate special preparations. A man will also have to take a running start against the wind with his flying apparatus, but on a horizontal surface even that will not be sufficient to free himself from the earth. But on taking a running start from a correspondingly inclined surface, it is easy to begin one's flight, even if there is no wind. According to the example of birds, man will have to start against the wind; but as an inclined surface is necessary for this, he needs a hill having the shape of a flat cone, from the top of which he may take starts against the wind in any direction. Such a place is absolutely necessary, if one wishes to make flying experiments in a convenient way without being dependent on the direction of the wind. For this purpose I have had an artifical hill, fifteen meters high, erected near my house in Gross Lichterfelde, near Berlin, and so have been enabled to make numerous experiments. The drawings show this hill or part of the same, from the outside.

If the atmosphere is undisturbed, the experimenter sails with uniform speed; as soon, however, as even a slight breeze springs up, the course of the flight becomes irregular. The apparatus inclines now to the right, now to the left.

The person flying ascends from the usual line of flight, and, borne by the wind, suddenly remains floating at a point high in the air; the onlookers hold their breath; all at once cheers are heard, the sailer proceeds and glides amid the joyful exclamations of the multitude in a graceful curve back again to the earth.

Can any sport be more exciting than flying? Strength and adroitness, courage and decision, can nowhere gain such triumphs as in these gigantic bounds into the air, when the gymnast safely steers his soaring machine house high over the heads of the spectators.

That the danger here is easily avoided when one practices in a reasonable way, I have sufficiently proved, as I myself have made thousands of experiments within the last five years, and have had no accidents whatever, a few scratches excepted. But all this is only a means to the end; our aim remains—the developing of human flight to as high a standard as possible. For the cuts and copy we are indebted to the Aeronautical Annual for 1896.

* The photographs were made by Drs. Neuhaus and Fulleborn, who used a camera constructed by Dr. Neuhaus on the Siegemann principle.

### International Exhibition of Agricultural Machinery.

The Department of State has been officially notified that an international exhibition of agricultural machinery will be held at Vienna, Austria, from the 9th to the 14th of May, 1896. American manufacturers are invited to participate in the exhibition. Exhibits sent from the United States will be readmitted duty free under the provisions of the tariff act now in force.

SOME friends of ours from Fairhaven, Mass., referring to the article on the Tack Industry, published in the issue of February 22 state that whereas the machine we described in one of our cuts turned out 270 tacks per minute, the machines in use in that city, some 200 being in use in one factory, turn out over 380 per minute.

THE arrival in London is noted of a large consignment of frozen salmon from British Columbia, in good condition and of excellent flavor, notwithstanding the fact that they were taken months ago and were sent to London via Australia, a distance of something like 22,000 miles.

### Preparations of Large Crystals.

R. Van Melckebeke (Pharm. Jour., lv, p. 535) prepares large crystals by a method of systematic culture. He first obtains, says Merck's Market Report, very regular detached small crystals by immersing linen threads in a saturated solution of the substance, which is then allowed to cool very slowly. The small crystals formed on the threads are examined with a lens, and all imperfect ones removed. The threads are then again immersed in a saturated solution of the salt, the vessel being covered with a bell glass, which also incloses a dish containing sulphuric acid. When the edges of the crystals measure 4 or 5 mm., another saturated solution of the salt is prepared at a temperature much above that of the surrounding atmosphere, filtered, and allowed to stand all night, some small crystalline particles being added so as to avoid oversaturation. The volume of this solution should be proportionate to the size of crystals desired; thus, for a crystal of 1 kg., 1 liter of solution should be prepared. The next day the solution is decanted into a confectioner's glass jar, and toward evening the crystals are immersed in it.

A convenient apparatus for this purpose is made like a scale pan. Two circular pieces of glass are supported by means of three copper wires, which are joined at the top, where a hook is formed, and wire triangles, midway and at the bottom, support the two plates. The apparatus is first moistened with the solution, the selected crystals are then placed on the glass plates, and the whole is then immersed and left until next morning, when the crystals are removed and carefully dried with a fine linen cloth. The strength of the solution must next be made up by dissolving in a small quantity of it the equivalent of the salt deposited during the night. The amount to be added will vary with the temperature and the size of the crystals, and must be found by experiment. If the solution be oversaturated, there will be an excessive deposit upon the crystals and plates, and if too weak the crystals will be eroded. When the resaturated solution is again of the temperature of the surrounding air, the crystals should be once more immersed over night, and the whole process must be repeated daily until the crystals are large enough. To insure the transparency of the crystals they may be moistened with alcohol before immersion in the solution, the surface layers of air being thus removed.

A perfect octahedron of potash alum, weighing 2 kg., and the edge measuring 13½ cm., was obtained by this process in about seven months.

### The American Institute Fair.

After a lapse of four years, the American Institute Fair is to be held this year in the Madison Square Garden, New York City. The fair will open on September 28 and will close October 29. It will be on the same lines as those held in the past. All of the departments will be on the main floor, with the exception of the machinery, which will be placed in the basement. Medals and diplomas will be given. The first exhibition of the institute was held in Masonic Hall, on Broadway, near Pearl Street, soon after it was organized in 1829, and successive fairs were held in Niblo's Garden, Castle Garden, and in the Crystal Palace, which was destroyed by fire in 1858 during the fair. The next year the fair was held in Palace Garden, in Fourteenth Street. In 1863 it was held in the Academy of Music and in 1864 in the Fourteenth Street Armory. In 1869 the Empire Rink, on Third Avenue, was first used for exhibition purposes, and in it the fairs were held until 1892. It was intended to hold the next fair in a new building to be erected on the same lot at an expense of $200,000, but as no agreement could be reached with the owners of the land, it was not built, and the exhibitions were suspended for four years. The "Fair of the American Institute" was quite an institution in New York and will doubtless be as well attended in the future as in the past.

ONE pound of cork is said to be amply sufficient to support a man of ordinary size in the water.

### X RAY PHOTOGRAPHY.

We reproduce from the Illustrirte Zeitung two very beautiful examples of X ray photography. The hand is of especial interest as being the first photograph that we have seen that shows clearly the position of the veins in the hand. The effect was produced by injecting a fluid in the hand of a corpse, thus making

AN X RAY PHOTOGRAPH OF A BIRD.

the veins opaque to X rays and enabling them to be photographed.

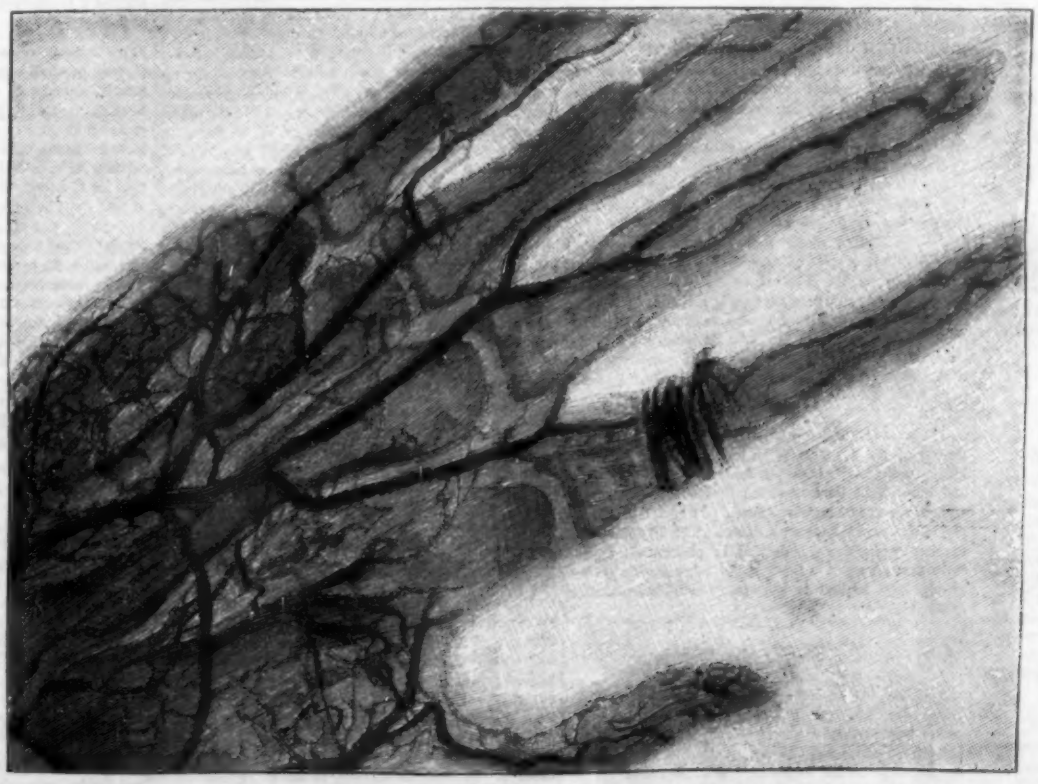
Among the experimenters who have lately had remarkable success in photography by means of the Roentgen rays is Dr. Fritz Giesel, of Braunschweig, whose photographs in natural colors have already made a reputation for him in the photographic world. His pictures of still life, showing the natural colors of fruit, flowers and birds, may certainly be classed as some of the best work of this kind ever done, and his success with the puzzling Roentgen rays is proved by the accompanying reproduction of a photograph of a canary bird taken immediately after death. The rays passed unimpeded through the feathers, nothing of which shows, the fleshy parts are lightly outlined, but the impenetrable bones have come out distinctly. The photographer was enabled to obtain this remarkably sharp impression by wrapping the plate in black paper, instead of putting it in a plate holder, and fastening the bird to it. The sharpness of the photograph increases, of course, as the distance of the object from the plate is decreased. Dr. Giesel exposed this plate for about twenty minutes.

It is to be hoped that the vacuum tubes may be improved so that the Roentgen rays can pass through them, giving the rays a much greater intensity outside of the tubes and thus doing away with the long and tiresome exposures now required. An improvement of this nature will be of the greatest importance in the application of the rays to diagnoses in medical practice.

Our second illustration is the photograph of the hand of a corpse, taken by means of the Roentgen rays, by Mr. Haschek and Dr. Lindenthal, in Prof. Franz Exner's physico-chemical institute, in Vienna. To them belongs the honor of being the first to apply the wonderful discovery of the Wurzburg investigator to a new branch of research. The veins, etc., in the hand—which was the hand of an old woman—are shown by the injection of Teichmann's mixture, which consists of lime, cinnabar and petroleum.

Turning now to other sources of information, we find that comparatively little that is new has been developed lately. Very good results have been obtained by Prof. Pupin, of Columbia College, using a six plate Holtz machine for exciting the Crookes tubes. This is an advance in the simplification of the process at least. Prof. McKay, of the Packer Institute, Brooklyn, exposes a number of plates at once to the rays emitted by a so-called perfect vacuum tube. He finds that it makes no difference in what position the plates are placed with reference to the tube. From Harvard University comes a new X ray lamp, with aluminum walls of conical shape. F. L. Lawrence, its originator, has obtained excellent X ray photographs with it on five seconds exposure, with 25,000 to 30,000 estimated potential difference. With higher voltage it is hoped that the exposure may be further shortened. In the German Reichstag, the Parliament Chamber was employed for a lecture on the subject by Prof. Speiss, who spoke of the probability in the near future of letters being read while in the mail boxes. Lead boxes would, he said, be a preventive. In Berlin, Prof. Bergmann performed the first surgical operation using X rays as yet executed there, extracting shot. He seemed apprehensive that their use might induce surgeons to extract missiles better left undisturbed.

Another interesting development is the production of direct optical shadow effects on a disk charged with barium platino-cyanide. This is the fluorescent salt used by Roentgen in his first experiments. A disk coated with a preparation of this salt is fastened over the end of a tube, phosphorescent surface inward. It is obvious that if X rays are allowed to fall upon the outside of the disk, it will appear luminous to an eye applied to the other and open end. On it Roentgen or X ray shadows can be produced by simply interposing a body opaque to the rays between the Crookes tube and the disk.



AN X RAY PHOTOGRAPH, SHOWING THE VEINS OF THE HAND OF A DEAD PERSON.

### The Life of the Steel Rail.

Mr. J. F. Wallace, writing in the Engineering Magazine for December, states that while it is true that there has been a steady and uniform decrease in the price of steel during the last quarter of a century, the average standard weight of rail for main lines has at the same time increased from 60 lb. to 99 lb. per yard, and the quality has materially depreciated. As an example of the deterioration that has taken place in quality, he states that during the past year he has relieved from a main track on tangents rails that weighed 75 lb. to the yard which had been in the track only five years; whereas, on the same district, and under precisely the same traffic conditions, there still remain in the track 60 lb. rails that have been in service for over fifteen years, which it was not considered necessary to renew this season. While this may be an exceptional case, he considers the steel rail which was furnished by the manufacturers fifteen to twenty years ago about 50 per cent better than the rail now manufactured. This is not intended to apply to special high class rails, which may be furnished by a few rolling mills under superior specifications, but to the ordinary rail supplied to and purchased by the majority of railroads.

ONCE every year the Emperor of China, amid great pomp and ceremony, plows a furrow in order to dignify agriculture in the eyes of his people.

## RECENTLY PATENTED INVENTIONS.

### Railway Appliances.

TRAIN MARKER AND SIGNAL LAMP.—Marion P. Cook, Denison, Texas. This inventor has devised a lamp in which the light may be differently colored, and the change of color quickly and conveniently made without opening the lamp. A guard or slide is provided for the passage of the adjusting device to prevent wind interfering with the flame. The lamp has two or more lenses or bull's eyes, for showing lights of different colors from the front and rear of the lamp, and from one side, the change of lights being instantaneous.

CAR DOOR.—Heinrich W. F. Jaeger, Sandusky, Ohio. According to this improvement tracks are mounted above and below the door opening, and a roller at one edge of the door engages one track, while within a slotted stationary housing at the opposite edge of the door is a movable housing engaged by a spring, a roller mounted in the movable housing having its trunnions slidable in the slots of the stationary housing. Owing to the peculiar construction of the rollers or casters, loose movement or play of the movable parts is prevented, and the door rides easily on its bearings with a minimum of friction.

TRACK BED SHAPER AND DITCHER.—James E. McCormick, Port Jervis, N. Y. To properly shape the earth and stone filling on the sides of the track bed, cutting the weeds and facilitating drainage, this inventor has devised a frame adapted for pivotal connection with the side of a car, and normally standing at an angle to the car, a knife carrier at whose lower end is a knife being held vertically adjustable on the frame, and the bottom edge of the knife being of a shape corresponding to the cross section of the side of the track. As the machine is pulled or pushed along the knife cuts into the sides of the track and removes surplus material, directing it to one side, and giving the desired and proper shape.

### Mining, Etc.

ORE CONCENTRATOR.—Joseph O. Dimmick and Edward K. Woods, Denver, Col. This invention consists in electric means for arresting and separating the metallic portions of granulated or pulverized pulp as it is forced by water over the concentrator bed. A bed of insulating material is placed over a pair of inclined metal tables, and rows of metallic pins extend from the metal bed through the bed of insulating material, while an electro-magnet has one pole connected to the metal bed plate of one table and the other pole to the metal bed plate of the other table. One table of a pair may be in concentrating operation while the other is being washed to clear it of concentrates.

CONDENSING LEAD FUMES.—Oliver R. Mollet, Joplin, Mo. To readily condense and collect the valuable particles in the fumes arising from the lead smelting process, this invention provides an apparatus comprising a mixing chamber connected with the smelting furnace and with an ordinary coal burning furnace, a fan drawing the mixed fumes from the mixing chamber to a settling chamber, where a strainer is movably held, each of the strainers being made of a perforated sheepskin, with the wool facing the inlet of the chamber. The occasional shaking of the strainers causes the solid matter adhering to the wool to drop into hoppers.

### Mechanical.

WRENCH.—Lewis P. Davidson, Denver, Col. This is a tool in which the movable jaw may be locked or released at any point in its travel on the shank by a slight movement of the thumb while the wrench is held in the hand. The invention is particularly applicable to that class of wrenches in which the handles are of two longitudinal parts between which the threaded shaft has a bearing. The wrench has but few parts, and is very simple, strong and inexpensive.

STOVEPIPE TOOL.—Albert B. Claflin, Staples, Minn. For those who have to set up stoves and stovepipes, this invention affords a convenient tool for cutting the pipes and crimping their edges where necessary to facilitate fitting their ends one within the other. At one end of the body or handle portion of the tool is a projecting knife, forming a novel and efficient pipe cutter, while at the other end intermeshing crimping wheels are journaled in forked arms, the edges of the pipe being crimped by being passed between the wheels.

### Agricultural.

PLOW.—Melvin M. Mullins, Monticello, Miss. This is a shovel plow, designed for use wherever a turning plow is ordinarily employed, and has a detachable point so fitted to the wing of the plow that the two will be virtually integral. Means are also provided whereby the wing and point may be adjusted to or from the ground, so that as the point wears out it may be carried downward and held in its adjusted position, enabling a point to be used until it is practically worn away, the wing and other portions of the plow being intact. A guided adjustment of the handles connected with the plow beam is also provided for.

### Miscellaneous.

ADDING MACHINE.—George W. Dudley, Charleston, West Va. In this machine the addition may be quickly effected in the column of any denomination without reference to the usual order of progression of units to tens, tens to hundreds, etc., the addition being performed by beginning at the left hand column or one of the middle columns of figures as well as if begun at the right hand. The machine has numbered rotating disks for the units, tens, hundreds, etc., each moving its neighbor of higher denomination at every tenth space, the disks being operated by levers and keys, and there being an internal sliding adjusting device by which all the keys may be made to operate on a disk of any desired denomination.

ADDING AND PRINTING MACHINE.—Two further patents have been granted the same inventor for an adding machine which, by the same manipulation of the keys, prints the figures on a sheet of paper in the order in which they are added, thus forming a proof sheet, the machine by special adjustments printing at the bottom of the column the sum total, doing the work by vertically ascending or descending progression, or in a horizontal order. With these features are combined, in the last patent, an improved mechanism for causing the keys to impart a variable throw to the adding wheels and type carrier, and for dispensing with the strain of turning at one time a number of the adding wheels. A novel organization of devices is also provided for spacing, adding and printing, or spacing without printing and printing without adding.

PROTECTOR FOR PNEUMATIC TIRES.—Zebulon Foster, Chicago, Ill. To prevent the puncture and damage of tires, this inventor provides a protective rim whose contiguous ends are enlarged and curved around the sides of the tire, being arranged one within the other and having their flat sides snugly engaged with each other. Each side of each end has an inwardly extending ear, the ears being longitudinally aligned, and being respectively engaged by threaded bolts and nuts to cause the rim to bind on the tire.

PROCESS OF OBTAINING PHENOLS.—Leonhard Lederer, Munich, Germany. To obtain pure phenols from substances containing them, such as crude cresols, xylenols, thymol, carvakrol, eugenol, guajakol, and creosol, this inventor has devised a process consisting in subjecting the substances to the action of chloracetic acid in the presence of alkaline lye, then treating the alkaline salts produced with suitable mineral acids to produce separate phenoxacetic acids, which are also treated with mineral acids to produce phenol.

FURNACE.—Thomas H. Lucas, Minneapolis, Minn. This is a furnace which may be used on boilers or for cooking or heating, and has a primary combustion chamber communicating with and receiving the gases from the fire pot, while a second combustion chamber covers or surrounds the primary chamber and communicates with it at the top through a restricted opening, there being means of supplying air to the primary chamber at the restricted opening. The furnace is designed to insure complete combustion and utilize the fuel to the best advantage.

BOILER.—George H. Hersey, Clifton, N. J. This boiler and its casing are made in sections which may be assembled to form a boiler of any size by using a greater or smaller number of sections, and is designed to afford simple and efficient means for heating buildings by hot water or steam. The boiler is formed of one or more series of hollow oblong metal loops connected at the ends and connected with steam or water distributing pipes, and the sectional inclosing case has a grate, ash pit, smoke bonnet, perforated baffle plate, and a draught chamber.

THREAD CABINET.—William K. Shelton and Perry H. Stewart, Hopkins, Mo. This is a revolvable polygonal cabinet with several main compartments adapted to display a number of shades of the same color of silk or thread, the cabinet also having a central and commodious storage compartment in which to keep surplus stock. Novel distributing devices are also provided whereby a particular spool may be easily withdrawn from any cell in the cabinet or from any of its columns of spools.

FOLDING LEG FOR FURNITURE.—Dan E. Carter, Traverse City, Mich. Brackets secured to the under face of a table or other article of furniture, according to this invention, have recesses in which are pivoted the legs, which carry clamping rods, adapted to draw the brackets together and lock the legs in position. The construction is especially adapted for benches, tables, cot beds, chairs, etc., the legs being readily held in folded position or position for support, and the locking device being simple and inexpensive.

DENTAL FORCEPS.—Sheldon A. Stienbarger, Augusta, Ill. Pivoted to these forceps is a fulcrum plate on which a rotary cam is mounted to turn to rock the forceps relatively to the fulcrum plate. The forceps are designed to facilitate drawing a tooth directly out without moving it laterally, rendering the work less difficult for the dentist and less painful to the patient.

BOX HINGE.—Charles L. Feinberg, Brooklyn, N. Y. This is an inexpensive and durable hinge, particularly adapted to mounting the lids of cigar and other light boxes, and the hinge may be applied without the use of nails or screws. It consists of two pivotally connected sections, one of which is applied to the box by pinching a projection in position after passing it through a slot in the box, the other section having an edge bent so that it is adapted to embrace one edge of the lid.

### Designs.

CUFF HOLDER.—Louis P. Kleiderer, Henderson, Ky. In this design the body of the cuff holder has parallel wavy lines, at one end of which are loops presenting a leaf-like figure, while at the opposite end is a large central loop with eyes at the sides.

GAME BOARD.—Volney K. Coffill, Brooklyn, N. Y. This board has disk-like figures printed about centrally on its four straight edges, while in the center of the board is a salient point surrounded by four groups of salient points, those of one set differing in color from those of the other sets.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

## Business and Personal.

*The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.*

Marine Iron Works. Chicago. Catalogue free.

"C. S." metal polish. Indianapolis. Samples free.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

Want Mach'y to manuf. on royalty. Box 56, Troy, N.Y.

For Sale—Patent No. 554,675, extending window sash For particulars address C. E. M., Box 773, New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Use the Hough Security Cash Recorder. Entirely different from a Cash Register. Hough Cash Recorder Co., Springfield, Mass.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

There are others, but they are not in it with the *Rome* nickel copper tea kettle. It leads them all. We want an opportunity to convince you. Circulars and prices given by Rome Manufacturing Company, Rome, N. Y.

☞Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

## Notes & Queries

### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
**References** to former articles or answers should give date of paper and page or number of question.
**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
**Buyers** wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.
**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.
**Books** referred to promptly supplied on receipt of price.
**Minerals** sent for examination should be distinctly marked or labeled.

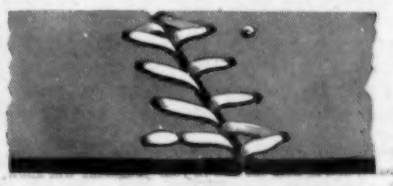
(6743) S. A. E. asks how to mount drawings on linen. A. The linen or calico is first stretched by tacking it tightly on a frame or stretcher. It is then thoroughly coated with strong size, and left until nearly dry. The sheet of paper to be mounted requires to be well covered with paste; this will be best if done twice, leaving the first coat about ten minutes to soak into the paper. After applying the second coat, place the paper on the linen and dab it all over with a clean cloth. Cut off when thoroughly dry.

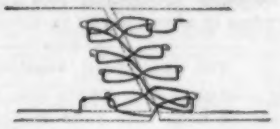
(6744) A. J. H. asks: 1. If you have a current of 100 volts and put a resistance of 100 ohms in this circuit, what would be the voltage of current after passing through resistance, or in other words how many volts would the 100 ohms resistance reduce the 100 volts? A. Voltage in the case named is treated not as something absolute, but as expressing a difference of potential. If 100 volts were expended in producing a current through the 100 ohm conductor, the potential difference between the terminals being 100, the potential difference for intermediate points would vary directly with the resistance between them. Thus between either end and the center there would be a potential difference of 50 volts. 2. Suppose you take a common telephone magneto and change it into a dynamo by putting in a commutator, take the fine wire off shuttle, now what number wire would you advise to put on shuttle so as to get best possible results and what size small lamp could you be able to light with it? A. For a small magneto we refer you to our SUPPLEMENT, No. 161, and for a drum armature for the same our SUPPLEMENT, No. 599. The winding of a magneto must be calculated for voltage and amperage desired, for "best results" is too indefinite. The armature of the magneto you allude to is not of good type for your purpose.

(6745) G. A. D. asks: 1. What is the smallest number of hydro-electric batteries of say 1 volt each that will cause a spark to pass over an air gap in a conductor, said air gap being one twenty-fifth of an inch wide, and the spark to play continuously (or as near to that as possible) between the two ends of the conductor? A. For sparking distance between ball electrodes the usual allowance is 10,000 volts for one-tenth inch. You will have to use a spark coil, as the battery on the above basis would be too large. 2. If same air gap were in a Geissler tube when it is at its best conducting condition, how many of the same cells would be required to cause said spark to pass? A. It depends on the size of the Geissler tube. A small one would show a one twenty-fifth inch spark. 3. How can I cause carbon (which has been made by carbonizing sugar) to dissolve in molten iron or silver. As soon as I put the carbon in the molten metal it rises to the top and burns away there, before it can be mixed enough to allow any of the carbon to dissolve in the molten metal. A. Try graphite or electric light carbons. You will not succeed in dissolving more than a trace, if that much, in silver. If you will have iron cast very hot in an iron mould, the piece cast being very thin, it will retain "dissolved" or combined carbon. 4. What is the greatest pressure we can exert on any substance, in pounds per square inch, and by what means that are available in practical application? A. It depends on the power of the press;—there is no limit assignable. The hydraulic press is usually available. 5. Please name a substance or two which I can practically introduce in a Geissler tube, to absorb the oxygen, so that, when I have exhausted the tube of air and the absorbent has got through absorbing the oxygen, there will be only nitrogen gas left in said tube. A. Metallic sodium carefully freed from naphtha. It is dangerous to handle.

(6746) B. E. R. asks: 1. How could the simple electric motor described in SUPPLEMENT, No. 641, be modified so as to develop (full) one-sixth or one-fifth horse power? Would it be sufficient to increase the thickness of the magnet core two or three layers, put one or two extra layers of wire on magnet, and use a current of twenty volts; or would it be necessary to make all parts of larger size? A. You would need a cast iron core to give it good residual magnetism, so as to make it self-starting. We strongly advise you to go on other lines and make such a dynamo as is shown in our SUPPLEMENT, No. 600. 2. Why will not the above motor operate as a dynamo, especially if the field is excited by a battery? A. It has too long and thin a core; it will generate current if you use it as described in your question. 3. How many amperes of current will a Daniell's cell generate, the porous cup of which is a common drain tile (with one end stopped), the copper and copper sulphate solution being in this, and surrounded to full height by the zinc and solution of salt? A. About ½ ampere through a low external resistance. 4. How many volts is the Edison-Lalande battery? A. 0·5 to 0·75 volt. 5. How long should a chromic acid porous cup battery operate with one charge? A. It depends on how much current is taken from it. 6. Is the energy of the battery wasted when the circuit is left open for a month or two? A. Yes. The zincs are rapidly attacked, the solution thus becoming spoiled. 7. How many square inches of zinc must be exposed in the above battery to produce one ampere of current? A. Three or four square inches. 8. How can silver be removed from old plated ware? A. By dipping in a mixture of a little strong nitric acid and strong sulphuric acid for articles of brass, copper, or German silver. For zinc, iron, tin, lead, Britannia metal or pewter, use a 10 per cent solution of potassium cyanide and make the article the anode, with a platinum, copper, or brass cathode. Both processes require watching, especially the first. 9. Will you please give directions for making an inexpensive compound for coating wooden battery cells, to render them acid proof? A. Melt together 4 parts resin, 1 part gutta percha and a little boiled oil. Apply hot, using a hot iron to work it into the corners and cracks.

(6747) A. J. C. asks how to lace belts. A. A correspondent in the SCIENTIFIC AMERICAN says: I send you a sample of belt lacing which I am using in my factory. It is far superior to any other way of lacing. It runs smoother on small pulleys, as it bends to





fit them. To lace it, commence in middle or either side. If in middle, divide the string into equal lengths; if on edge, same as sketch, by fastening one end and running across and back. You will readily see its advantages. I suggest it so others may be benefited.

(6748) D. M. H. says: Please let me know through Notes and Queries how to make a mould to cast one-half sphere plaster figures in. A. A good gelatine mould may be made in the following manner: Soak the best white glue in cold water for 24 hours, then drain off all the water. Melt the soaked glue in a water jacketed kettle, then pour the glue upon the object, the latter being incased in a lead or pasteboard box. Let it cool for 12 hours, then separate the cast from the object. If the object be a statuette, a thread should be attached to the back, and extended out of the mould at both ends, so that it may be used for cutting open the mould after it is cooled, to permit of taking out the statuette. A good material for a mould is made in the following way: Dissolve 20 parts of fine gelatine in 100 parts of hot water, and add ¼ part of tannin and the same amount of rock candy. It is said that a mould made of gelatine or glue alone may be made more durable by pouring over it a solution of bichromate of potash in water, 1 part of bichromate to 10 parts of water, and afterward exposing it to sunlight. Most objects require oiling slightly before being covered with glue or gelatine.

(6749) A Subscriber writes: I wish to build an air motor to run small electric light plant. 1. How large a storage battery is necessary for 6 incandescent lights? A. A typical cell gives 35 amperes at 2 volts. By using 20 volt lamps you can get on with ten such cells and have still an excess. Allow 20 volts and 3·40 amperes per lamp. 2. How large a dynamo for same? A. See our SUPPLEMENT, No. 600, for full description. 3. About how large a wheel? Winds here in mountains are strong. A. A one horse power wheel would be ample. 4. Will kerosene at 80 cents per gallon be economical or not? A. If you can handle the plant, it might be economical; the chance of its proving so will be greater as its size is greater. For size given, the personal attention required would militate against it.

(6750) I. W. T. writes: I am making a coil for demagnetizing watches, using a 120 volt alternating current, and would like to know the size and amount of wire for same. A. Use three or four pounds No. 20 wire. Wind around a core of the section suited for the largest size watch. There is no harm in giving plenty of room.

(6751) L. W. G. says: Would you kindly give me a recipe for coloring incandescent lamps red and blue that will not crack or blister? A. 1. Prepare the glass by thoroughly washing in soap and water and drying. Then dip in bath made by beating up the whites of two eggs in 1¼ pound or pint of water and filtering, and

hang up to dry. Dissolve the aniline color in photographer's common collodion. 2. Red or blue aniline will form clear solutions, while the green solution will require filtering. 3. Yellow aniline forms a handsome color, but the surface of the glass presents a frosted appearance after the application. 4 Violet and purple colors may be obtained by combining red and blue in different quantities. When the solution is ready, dip the prepared glass bulbs therein, hang up to dry, and finally pass a current through the bulb for half an hour, that the heat thus generated may harden the coating of the collodion, or place in a current of air. 5. The preparation can easily be removed with alcohol or sulphuric ether, but is not affected by water. Experience has shown that the best results are obtained by not using too much aniline. Make the color light rather than deep, and apply two or three coats.

**(6752) N. S. C. says: Can you send me** a recipe for a tonic which will cause a growth of hair on the head or face? A. Salicylic Hair Tonic:

| | |
|---|---|
| Salicylic acid | 50 grn. |
| Borax | 2½ drm. |
| Tincture of cantharides | 1½ fl. oz. |
| Bay rum | 6 fl. oz. |
| Rose water | 6 fl. oz. |
| Boiling water—enough to make | 18 fl. oz. |

**(6753) L. A. M. asks how to mix lime to** whitewash brick walls, inside and outside walls, so that the lime will adhere. A. A good durable whitewash is made as follows: Take ½ bushel of freshly burnt lime, slake it with boiling water; cover it during the process, to keep in the steam. Strain the liquid through a fine sieve, and add to it 7 lb. of salt previously well dissolved in warm water; 3 lb. of ground rice boiled to a thin paste and stirred in boiling hot; ½ lb. of powdered Spanish whiting; 1 lb. of clean glue, which has been previously dissolved by soaking it well, and then hanging it over a slow fire in a small kettle, within a large one filled with water. Add 5 gall. of hot water to the mixture, stir it well, and let it stand a few days covered from dirt. It must be put on quite hot. For this purpose it can be kept in a kettle on a portable furnace. About 1 pt. of this mixture will cover a square yard.

**(6754) E. L. F. asks, How fast will a one** half horse power steam engine run a 12 foot boat and what size propeller will be needed? A. A ¼ horse power engine should give a speed 6 to 7 miles in a 12 foot boat with good lines, with a 12 inch propeller.

**(6755) D. D. asks for the size of boiler** to work slide valve engine 1½ inch stroke, 1 inch bore, for 1½ hours at 50 pounds pressure. A. You will require a boiler rated at ½ horse power, or having 6 square feet of heating surface. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 702, for illustrations of small safe boilers. 10 cents mailed.

**(6756) J. A. H. asks: Can you give me** the proportions of wooden patterns to make the following sizes of cast iron dumb bells: 25 lb., 50 lb. and 100 lb.? A. Make an accurate drawing of a longitudinal section of the dumb bell of the pattern that you desire to make, and as near the size as your judgment will allow, then compute the contents in cubic inches and multiply by 0·24 for pounds in the casting.

**(6757) J. P. asks: 1. How can I muffle** the exhaust of my gas engine so it will not make so much noise? I use the engine to run my buggy. A. You can make the exhaust nearly silent by connecting with an iron box or cylinder of three or four gallons capacity, with several diaphragms of ½ inch mesh wire cloth. 2. What causes the sharp snapping sound in gas engine cylinders which occurs every little while? A. The sharp snap is probably due to a miss fire, by which the second charge becomes stronger and makes a heavier explosion, making the engine jump. 3. What is meant by "machine sparking"? You used this term in speaking of the Benz motocycle. A. The term sparking probably refers to the electric spark used for igniting the explosive mixture.


### TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.


## INDEX OF INVENTIONS

**For which Letters Patent of the United States were Granted**

**February 25, 1896,**

**AND EACH BEARING THAT DATE.**

[See note at end of list about copies of these patents.]

Air compressing and storing apparatus, E. C. Nichols ..... 555,178
Alarm. See Fire and burglar alarm. Thermostat-actuated alarm.
Alternating motor, N. Tesla ..... 555,190
Animal trap, J. B. Perkins ..... 555,117
Annunciator, electric, J. Kips ..... 555,101
Annunciator, electrical, F. Porath ..... 555,120
Arithmetical apparatus, E. E. Matsson ..... 555,218
Armature winding, W. H. Knight ..... 555,216
Axle box, car, A. D. Richmond ..... 555,194
Badge, B. S. Whitehead ..... 555,197
Bank, savings, H. H. Norrington ..... 555,111
Bankers, etc., financial instrument for use of, C. W. & W. L. Walters ..... 555,220
Battery. See Primary battery.
Bearing, rock shaft, J. G. Stuckstede ..... 555,346
Bed, folding, J. D. Ennes ..... 555,441
Bed, folding, J. G. Winship ..... 555,415
Bedding ventilator, A. Fraser ..... 555,307
Bell, door, W. H. Pauber ..... 555,206
Belt coupling, H. S. Armfield ..... 555,094
Bicycle attachment, E. J. Taylor et al ..... 555,271
Bicycle driving mechanism, J. P. Hallenbeck ..... 555,243
Bicycle gearing, S. A. White ..... 555,374
Bicycle handle bar and attachment, Dieterich & Boulton ..... 555,150
Bicycle lamp holder, F. Rhind ..... 555,193
Bicycle lock, keyless, J. A. Folsom ..... 555,477
Bicycle support, F. Giacinto ..... 555,256
Blacking box, J. Stevenson ..... 555,419
Blind stop, C. W. Kali ..... 555,169
Boiler, E. F. Edgar ..... 555,226
Bottle, C. M. Freeman ..... 555,151
Bottles, cap to prevent refilling, J. J. Walsh ..... 555,348
Bottling machine, R. M. Hunter ..... 555,166
Bottom for metallic vessels, D. A. Lisk ..... 555,457
Box. See Axle box. Blacking box. Grain box. Turpentine box.
Brake. See Carriage brake.
Brick repressing machine, W. W. Wallace ..... 555,349
Brick veneer, G. L. Baisley ..... 555,358
Broom holder, H. A. Frantz ..... 555,085
Bubble pipe, soap, E. S. Thain ..... 555,411
Buckle, A. M. Ziegler ..... 555,377
Burner. See Evaporator burner. Gas burner. Vapor burner.
Burner, B. S. Dunn ..... 555,300
Calendering paper, etc., machine for, H. Linton ..... 555,395
Call and alarm apparatus, electric, Hartfuss & Hers ..... 555,160
Can. See Oil can.
Can opener, F. E. Garner ..... 555,315
Can opening device, G. J. Record ..... 555,234
Canceling and stamping device, F. T. Bailey ..... 555,357
Cane lift tripping attachment, A. A. Morrow ..... 555,462
Capstan, C. A. Potter ..... 555,121
Car brake shoe, railway, H. F. Shaw ..... 555,343
Car controlling system, H. E. Hunt ..... 555,376
Car coupling, J. W. Colbert ..... 555,430
Car coupling, D. Collen ..... 555,364
Car coupling, J. Davis ..... 555,437
Car coupling, A. C. Hight ..... 555,445
Car coupling, Johnson & Hoots ..... 555,168
Car coupling, J. Lessard ..... 555,394
Car fender, N. J. Biahoprick ..... 555,304
Car fender, U. Dietz ..... 555,283
Car fender, R. S. Flint ..... 555,083
Car fender, F. W. Lafferty ..... 555,392
Car fender, W. Leonhardt ..... 555,105
Car fender, S. A. Politzky ..... 555,119
Car fender, C. M. Pratt ..... 555,400
Car fender, A. Steiert ..... 555,209
Car fender, street, R. W. Gibson ..... 555,316
Car lighting apparatus, electric, W. Biddle ..... 555,068
Car signal, E. Nelson ..... 555,391
Car, sleeping, E. E. Castle ..... 555,361
Cars, device for preventing motion on, A. E. Flatlick ..... 555,236
Cars, electric motor for street, H. M. Neer ..... 555,392
Cars, illuminated sign for electrically driven street, R. H. Engle ..... 555,440
Carding engine, J. T. Meats ..... 555,224
Carding engine flats, apparatus for controlling the grinding of, J. E. Prest ..... 555,329
Carpet stretcher, C. A. Chamberlain ..... 555,362
Carriage brake, child's, Mackenzie & Hollingshead ..... 555,458
Cartridge loading implement, C. F. Fellows ..... 555,237
Case for containing sugar, etc., W. Wale ..... 555,134
Cash register, L. Cooney, Jr ..... 555,302
Cash register, P. Yoe ..... 555,276
Cash register and indicator, J. P. Cleal ..... 555,282
Cash register and indicator, A. Smithson ..... 555,407
Caster, ball, W. H. Lockerby ..... 555,175
Ceiling, W. Hurd ..... 555,097
Cement flags or artificial stone, apparatus for making, E. Smallwood ..... 555,345
Centerboard for yachts and other vessels, F. R. Kruse ..... 555,250
Checkrein hook, H. P. Hartwell ..... 555,444
Chimney collar or protector, E. Henshaw ..... 555,095
Chimney ventilator or cowl, J. Jedlicka, Sr ..... 555,448
Cider press, Cline & Ecker ..... 555,429
Cigarette, B. Baron ..... 555,430
Cigarette, machine, E. Georgii ..... 555,309
Cigarette machine, continuous, B. Baron ..... 555,417
Cigarette making machine, B. Baron ..... 555,418
Cigarettes, method of and apparatus for manufacturing, B. Baron ..... 555,419
Clevis, R. L. Yeakey ..... 555,469
Clock, J. T. Long ..... 555,387
Clock, electric, S. Fischer ..... 555,313
Clock, secondary electric, F. L. Gregory ..... 555,090
Clock striking mechanism, G. M. Bilger ..... 555,205
Coal separator, J. R. Richardson ..... 555,185
Coal tipple, T. B. De Armit ..... 555,305
Cock, stop and waste, F. A. Radcliffe ..... 555,122
Coffee pot, H. Nicholson ..... 555,394
Collar, horse, Garnier & Prescott ..... 555,097
Composition of matter, E. C. Brice ..... 555,301, 555,425
Condenser and lint cotton conveyer, storage, J. S. Tennison ..... 555,189
Conveying apparatus, J. G. Delaney ..... 555,080
Copy holder, W. R. Koller ..... 555,249
Corset, M. E. Hall ..... 555,157
Coupling. See Belt coupling. Car coupling.
Coupling, J. J. Ricketts ..... 555,204
Cradle, spring, J. T. Murphy ..... 555,268
Crimping machine, E. P. Holden ..... 555,244
Crosshead, G. A. Anderson ..... 555,296
Cultivator, R. H. Hick ..... 555,165
Cutter. See Revolving cutter.
Damn, hydraulic splash board for, R. A. Lang ..... 555,102
Dental plate and making, J. F. X. Hamer ..... 555,158
Desk support, F. W. Tobey ..... 555,205
Die. See Press die. Screw cutting die.
Digger. See Potato digger.
Douche, nasal, M. G. Melvin ..... 555,107
Draughting device, T. F. Horrigan ..... 555,227
Dress shield, V. Lavalletto ..... 555,393
Drill. See Rock drill.
Drilling apparatus, W. L. Fifield ..... 555,442
Drilling machine, reciprocating, A. E. W. Meisner ..... 555,264
Dry kiln, A. T. Bemis ..... 555,067
Dye and making same, red, Bernthsen & Julius ..... 555,359
Electric conductors, machine for connecting, H. J. Savory ..... 555,405
Electric distribution system, E. C. Myrick ..... 555,226
Electric distribution system, regulating, J. Burke ..... 555,301
Electric heater, J. F. McElroy ..... 555,259
Electric lighting system, S. L. Tripp ..... 555,192
Electric machines and motors, brush for dynamo, F. W. Kreinberg ..... 555,381
Electric motor, E. Thomson ..... 555,191
Electric motors, system of control for, E. A. Sperry ..... 555,291
Electric transformer, W. Carter ..... 555,074
Electric visual indicator, Cole & Chapman ..... 555,076
Elevator controller, E. C. Jenkins ..... 555,167
Elevator controller, electric, E. P. Warner ..... 555,136
Elevator safety device, M. C. Littleworth ..... 555,456
End gate, C. A. Anderson ..... 555,200
Engine. See Carding engine. Gas engine. Steam engine.
Evaporator burner or stove, Z. Davis ..... 555,436
Extirpator, Merrel & Duffek ..... 555,219
Eyeglasses, bar spring, E. B. Meyrowitz ..... 555,459
Fan, M. Rubin ..... 555,402
Fan, motor driven, S. O. Tuerk ..... 555,294
Feed trough, W. W. Simcoe ..... 555,280
Fence, G. G. Gayman ..... 555,098
Fence machine, spreader and twister for, J. & C. Lane ..... 555,453
Fence, wire, A. J. Upham ..... 555,193
Fender. See Car fender.
Fertilizer distributer and seed planter, F. Bateman ..... 555,421
File for newspapers, bills, letters, etc., B. McGinty ..... 555,289
File or paper clip, letter, N. H. Voss ..... 555,229
Filter and cleaner, W. B. Lindsay et al ..... 555,104
Filtering apparatus, R. W. Jacob, Jr ..... 555,098
Fire and burglar alarm, R. L. Levin ..... 555,173
Fire extinguisher, automatic, E. Livingston ..... 555,396
Fireproof construction, A. R. Fordyce ..... 555,084
Flashlight burners, electric receptacle for flashing powder in, Rathbun & Bebby ..... 555,332
Flashlight machine, C. D. Vernon ..... 555,133
Forceps, gynecological, F. Wagner ..... 555,194
Furnace, M. J. Graney ..... 555,371
Furnace, J. Kritch ..... 555,172
Fustians, etc., machine for cutting nap of, F. Alsina ..... 555,416
Game apparatus, S. W. Featherstone ..... 555,213
Game apparatus, J. F. Morris ..... 555,220
Gas burner, L. Denayrouze ..... 555,307
Gas burner, E. M. Wescott ..... 555,141
Gas engine, Agerell & Williams ..... 555,355
Gas holder guide, H. Hacker ..... 555,215
Gas, making and consuming, T. L. Willson ..... 555,198
Gas, process of and apparatus for burning liquefied, E. N. Dickerson ..... 555,149
Gas, process of and apparatus for producing illuminating, E. N. Dickerson ..... 555,212
Gases, metallic vessel for compressed, A. W. Browne ..... 555,300
Gate, self-end gate ..... 555,437
Gate, F. V. Burner ..... 555,206
Gear, compensating, G. A. Anderson ..... 555,295
Generator, constant potential alternating, W. K. Freeman ..... 555,152
Glass, manufacture of wire, C. S. Weber ..... 555,351
Glass ornamenting machine, J. Holbrook ..... 555,164
Gold and silver from ores, extracting, McArthur & Ellis ..... 555,463
Grader, road, J. M. Holland ..... 555,096
Grain box, L. S. Safford ..... 555,127
Grating fruits, etc., machine for, W. R. Respess, Jr ..... 555,124
Grooving and seaming machine, C. L. Ridgway ..... 555,235
Gun mounting, Buffington & Crosier ..... 555,426
Guns, choke attachment for, R. P. Cory ..... 555,279
Hame, R. G. Armstrong ..... 555,434
Harrow, G. C. Billups ..... 555,143, 555,144
Harvester, corn, W. W. Smith ..... 555,408
Harvester, cotton, C. W. Edgar ..... 555,439
Harvester, cotton, C. H. Pickering ..... 555,118
Harvesting machine elevator, J. B. Grimmett ..... 555,481
Hat pin, O. J. Jones ..... 555,100
Hay and stock rack, T. Toohey ..... 555,347
Heater. See Electric heater. Hot water heater. Steam heater. Water heater.
Heating and stirring milk, etc., apparatus for, J. L. Jonsson ..... 555,451
Heddle rod tightener, F. A. Garnsey ..... 555,086
Heel for shoes, spring, H. D. Richey ..... 555,402
Heel nailing machine, Glidden & Elliott ..... 555,341
Heel trimming machine, C. W. Glidden ..... 555,340
Hogs, apparatus for gathering, elevating, and transporting, S. Dederick ..... 555,233
Hook. See Checkrein hook.
Horses, apparatus for stopping runaway, P. Arriaran ..... 555,356
Horseshoe, A. H. Carroll ..... 555,361
Hot water heater, J. G. Shearlock ..... 555,467
Hub-boring machine, C. E. Lipe ..... 555,253
Indicator. See Electric visual indicator. Street indicator. Welding indicator.
Insecticide distributing machine, W. R. Monroe ..... 555,256
Iron, machine for cutting bar, Seiple & Brookins ..... 555,404
Ironing board, H. Barclay ..... 555,471
Ironing table, H. Stone ..... 555,225
Jack. See Lifting jack.
Jewel setting machine, G. E. Hunter ..... 555,447
Joint. See Lock joint.
Journal bearing, J. P. McGarry ..... 555,109
Kiln. See Dry kiln.
Knife. See Pineapple knife.
Knife milling machine, table, C. E. Roberts ..... 555,125
Knitting machine transferring device, H. E. Harbaugh ..... 555,161
Ladder, step, H. C. Hachmuth ..... 555,156
Ladle, W. Hainsworth ..... 555,317
Lamp air distributer, H. E. Shaffer ..... 555,191
Lamp for vehicles, electric, W. A. Crowdus ..... 555,305
Lamp shade, Walsh & Williamson ..... 555,135
Lamps, hanger board for arc, A. J. Oehring ..... 555,112
Lamps, spark arrester for arc, C. Winston ..... 555,199
Lantern, W. C. Vajen ..... 555,132
Lantern hanger, signal, E. R. Knowles ..... 555,330
Latch, H. B. Worsey ..... 555,364
Lead by electrolysis, manufacturing white, Browne & Chaplin ..... 555,223
Level, engineer's Y., C. L. Berger ..... 555,251
Lifting jack, P. M. Gunter ..... 555,091
Lifting jack, E. M. Robinson ..... 555,205
Line fastener, J. Schwarzmann ..... 555,340
Liquid dispensing apparatus, W. M. Fowler ..... 555,294
Liquids, means for clarifying, O. E. Michaud ..... 555,398
Lock. See Bicycle lock. Padlock. Permutation lock. Seal lock.
Lock, F. H. Bullis ..... 555,300
Lock, F. & M. Clever ..... 555,309
Lock, F. Soley ..... 555,134
Lock joint, H. F. Ascheck ..... 555,301
Lubricating journal bearings, means for, W. A. Mack ..... 555,176
Lubricator, E. Jacobi ..... 555,346
Measuring instrument, electrical, Von Hefner-Alteneck & Gorges ..... 555,286
Mechanical movement, E. F. Edgar ..... 555,295
Merry-go-round, W. Meissner ..... 555,225
Milling machine, R. F. Hall ..... 555,373
Milling machine, automatic valve, Oliver & Bardons ..... 555,116
Motor. See Alternating motor. Electric motor. Railway motor.
Musical instrument, mechanical, H. F. Hambruch ..... 555,150
Mustache guard, Wernmann & Weber ..... 555,140
Nailing machine, J. B. Flint ..... 555,314
Necktie turning machine, J. F. Keating ..... 555,170
Nut lock, G. W. Packer ..... 555,390
Oculist's testing frame, G. W. Wells ..... 555,196
Oil can, A. Hitt ..... 555,318
Oiler, automatic, W. J. Ferguson ..... 555,475
Operating table, R. Kny ..... 555,252
Padlock, J. Roche ..... 555,337
Paint, T. Mott ..... 555,221
Paint, composition for removing, C. S. Bailey ..... 555,066
Paper box sanding machine, H. Mott ..... 555,399
Paper feeding machine, F. Van Benthuysen ..... 555,422
Pegging machine, J. F. Davey ..... 555,434
Pencil, H. H. Seaman ..... 555,341
Permutation lock, W. S. Chedister ..... 555,474
Permutation lock, J. Rocke ..... 555,336
Petroleum motor, F. Henriod-Schweizer ..... 555,373
Photographic retoucher, D. M. Harshman ..... 554,243
Pianoforte, R. M. Squire ..... 555,409
Picture or mirror frames, back for, C. Schmitt ..... 555,186
Pin. See Hat pin.
Pineapple knife, M. F. Postley ..... 555,398
Pipe. See Bubble pipe. Reed pipe. Spraying pipe.
Pipe connection, automatic, H. Reed ..... 555,333
Pipe coverings, apparatus for making steam, J. M. Bolton ..... 555,071
Pitcher, syrup, H. Nolen ..... 555,396
Planter, corn fertilize corn, J. Kaylor ..... 555,319
Pliers, cutting, C. Morrill ..... 555,108
Plow attachment, S. D. McMillan ..... 555,327
Plow, rotary, L. D. Railsback ..... 555,331
Pneumatic dispatch tube, W. G. Collins ..... 555,079
Pneumatic separator and drier, A. Gnadt ..... 555,370
Pneumatic tube, W. G. Collins ..... 555,077, 555,078
Pocket, garment, E. J. Curran ..... 555,435
Pocket, watch, Tauber & Odenheimer ..... 555,227
Potato digger, W. S. Leidiger ..... 555,251
Potato harvester, J. Radermacher ..... 555,401
Precious metals from solutions, recovering, Wiswall & Frank ..... 555,482
Press. See Cider press.
Press die, drop, W. H. & W. J. Clark ..... 555,303
Primary battery, W. A. Crowdus ..... 555,305, 555,304
Printing machine, rotary, J. Michaud ..... 555,460
Printing sign cards, machine for, F. W. Maxson ..... 555,106
Propulsion of vessels, electrical, E. A. Le Sueur ..... 555,252
Pump, Grosse & Walther ..... 555,214
Pump, W. D. Hooker ..... 555,096
Pump, force, O. F. Smith ..... 555,188
Punch for bicyclists' use, cutting, F. C. Durant ..... 555,294
Puzzle, A. Keiser ..... 555,388
Rack. See Hay and stock rack.
Rail cleaner, R. Leslie ..... 555,454
Railway, W. A. Emond ..... 555,081
Railway buffer arrester, J. A. Weber ..... 555,273
Railway, conduit electric, C. M. Bridges ..... 555,208
Railway crossing, Johnson & Fry ..... 555,449
Railway, electric, W. H. Jordan ..... 555,248
Railway motor, E. M. Boynton ..... 555,290
Railway purposes, life-saving device for, W. H. Martin ..... 555,177
Railway signal system, electric, J. Irwin ..... 555,167
Railway switch, C. H. Krauss ..... 555,171
Railway switch, W. Raymond ..... 555,183
Railway trains, pneumatic brake apparatus for, A. Wenger ..... 555,196
Railway vehicles, brake apparatus for, F. Chapsal ..... 555,075
Railways, electric signaling device for, G. A. Lyncker ..... 555,217
Railways, sectional conductor for electric, W. H. Baker ..... 555,470
Railways, underground conductor system for electric, C. T. H. Schwieger ..... 555,300, 555,374
Reed pipe, E. Howard ..... 555,098
Register. See Cash register.
Revolving cutter, C. A. Smith ..... 555,408
Rivet, R. B. Waters ..... 555,137
Riveting, electric, E. Thomson ..... 555,151
Rock drill, A. Schedl ..... 555,128
Rolling mill repeater, S. V. Huber ..... 555,375
Sash fastener, Gardner & Appleton ..... 555,368
Scaffold, H. McLaughlin ..... 555,260
Scraper and carrier, road, J. A. Taylor ..... 555,270
Screen. See Shaker screen.
Screw cutting die, A. J. Smart ..... 555,405
Seal lock, B. H. Tyson ..... 555,413
Seam for sewed articles, W. P. Gammons, Jr ..... 555,478
Seam, welted, F. W. Merrick ..... 555,256
Seed delinter, cotton, J. J. Faulkner ..... 555,309 to 555,312
Separator. See Coal separator. Pneumatic separator.
Sewing machine, hat, W. P. Gammons, Jr ..... 555,479
Sewing machine work plate, C. H. Fogg ..... 555,476
Shaker screen, D. E. Phillips ..... 555,262
Sheet metal articles, making spotted, E. Puttmann ..... 555,224
Shingle sawing machine, F. Challoner ..... 555,148
Shoes, stay for ankle portion of, A. Posener ..... 555,328
Shoulder brace and suspenders, F. Trambley ..... 555,272
Sideboard and extension table, combination, E. Unger ..... 555,413
Sifting and sorting flour, meal, etc., machine for, D. R. Morrison ..... 555,461
Signal. See Car signal.
Sink and trap, combined, J. Johnston ..... 555,485
Skate sharpener, A. D. Banker ..... 555,209
Skirt, bicycle, E. H. Cooper ..... 555,211
Skirt, cycling, A. L. Byarrave ..... 555,428
Sodawater fountain, J. F. Huber ..... 555,446
Soldering machine, can, M. Jensen ..... 555,247
Spark arrester, G. A. Anderson ..... 555,297
Speed governor for motors, J. Dow ..... 555,438
Spindle support, A. Scheid ..... 555,129
Spinning and twisting machine, Mestre & Mascu ..... 429,625
Spinning fibrous materials, apparatus for, N. Capers (r) ..... 11,594
Spokeshave and rabbet plane, J. A. Traut ..... 555,228
Spraying pipe, flexible, J. H. Burck ..... 555,147
Springs, making vehicle, G. T. Glover ..... 555,153
Spudding shoe, I. L. Neely ..... 555,110
Starching machine, collar and cuff, M. Collins ..... 555,310
Steam engine, T. T. Prosser ..... 555,405
Steam heater, antifreezing, W. Parrett ..... 555,223
Stone, artificial, E. C. Brice ..... 555,297
Stone, brick, etc., manufacture of artificial, E. C. Brice ..... 555,300
Stove, folding, W. H. Enfield ..... 555,088
Stove, heating, B. F. Wheiden ..... 555,414
Stove, heating, J. Wilson ..... 555,353
Stovepipe thimble, J. J. Schaab ..... 555,207
Stove, vapor, T. Johnson ..... 555,450
Stoves, filter for gasoline, J. Hussey ..... 555,482
Stoves, heating attachment for gas or other, F. L. Rice ..... 555,406
Straw stacker, J. B. Bartholomew ..... 555,086
Straw stacker, P. Knapp ..... 555,379
Street indicator, W. Straley ..... 555,226
Street sweeper, H. L. Carpenter ..... 555,473
Stretcher frame, Arbogast & Keller ..... 555,278
Swing, revolving, C. W. Rodehafer ..... 555,338
Switch. See Railway switch. Trolley wheel switch.
Switch, H. S. Webster ..... 555,352
Table. See Ironing table. Operating table.
Tablet making machine, J. H. Lowing ..... 555,105
Tap or other valve, C. C. Lindsell ..... 555,174
Telegraphic repeater, L. Horton, Jr ..... 555,165
Telephone, M. Gari ..... 555,240
Telephone communication, short distance, W. L. Bradshaw ..... 555,073
Telephone system, railway, W. H. Nixon ..... 555,223
Telephone transmitter, A. Graham ..... 555,154
Theater apparatus for producing sun effect, scenic, Oehring & Tucker ..... 555,113
Theaters, circuit controlling apparatus for scenic, Oehring & Tucker ..... 555,114
Theaters, proscenium curtain for, Oehring & Tucker ..... 555,115
Thermometer, oven, G. E. Wilbur ..... 555,275
Thermostat-actuated alarm, F. B. Bigelow ..... 555,069
Thill support, G. L. Bowman ..... 555,072
Tire, bicycle, P. J. McLain ..... 555,464
Tire valves, testing device for pneumatic, A. M. Shurtleff ..... 555,344
Tires, device for putting on rubber, A. W. Grant ..... 555,499
Tool support, P. Hammer ..... 555,092
Tooth cleaning instrument, J. Wells ..... 555,139
Toy, J. F. Prentice ..... 555,181
Track and track hanger, W. Louden ..... 555,321
Traction wheel, A. E. Price ..... 555,330
Trap. See Animal trap.
Trestle for plasterers, etc., E. Sprague ..... 555,269
Trolley wheel switch, F. A. Williams ..... 555,145
Trough. See Feed trough.
Tube. See Pneumatic tube. Pneumatic dispatch tube.
Tubular bodies, process of and apparatus for electrolytically forming, I. Klein ..... 555,462
Tug, shaft, J. P. Crews ..... 555,484
Turpentine box, G. I. Smith ..... 555,203
Typewriting machine, B. Granville ..... 555,443
Typewriting machine, G. B. Webb ..... 555,198
Typewriting machines, duplex ribbon mechanism for, J. T. Davis ..... 555,435
Valve, E. A. Benner ..... 555,202
Valve, H. E. Hunt ..... 555,377
Valve, engine cut-off, J. B. Pitchford ..... 555,397
Valve, gas controlling, W. P. Powers ..... 555,330
Valve gear, G. A. Anderson ..... 555,293
Valve motion for gas and petroleum engines, eccentric outlet, W. Seck ..... 555,342
Vapor burner, G. W. Billings ..... 555,070
Vehicle luggage carrier, C. J. Brosnan ..... 555,472
Vehicles, contact device for electrically propelled, E. B. W. Reichel ..... 555,263
Ventilator. See Bedding ventilator. Chimney ventilator.
Ventilator, Conard & Collins ..... 555,431
Veterinary speculum, M. McNalley ..... 555,390
Wagon, delivery, L. E. Bessette ..... 555,423
Washing machine, R. W. & A. W. Allen ..... 555,093
Watches, mailing or shipping package for, E. A. Marsh ..... 555,322
Water closet and urinal, S. W. Lewis ..... 555,455
Water elevating apparatus, A. M. Putnam ..... 555,122
Water heater, Houser & Hobrock ..... 555,245
Water heater and purifier, combined, T. Gunning ..... 575,155
Weeder, W. E. Whitman ..... 555,142
Weighing machine, automatic, W. E. Nickerson ..... 555,393
Weighing machines, door for automatic, W. E. Nickerson ..... 555,179
Welding indicator, electric, E. Thomson ..... 555,150
Well apparatus, sheave attachment for oil, S. G. Roebling, Jr ..... 555,126
Wheel. See Traction wheel.
Wheel rim, J. A. Dana ..... 555,308
Wick, lamp, S. B. Morse ..... 555,257
Wicker work, O. M. O'Hearn ..... 555,180
Window, Von Heydebrand und der Lasa ..... 555,183
Window, J. F. Parker ..... 555,261
Window, W. H. Wasemann ..... 555,350
Wire twisting machine, J. A. Barrett ..... 555,146
Wood grinder, F. Hiorts ..... 555,094
Woodworking machinery, E. Judd ..... 555,376

## TRADE MARKS.

Antiseptics, food preservatives, and allied preparations, Patent Borax Company ..... 27,853
Baked cereal products, J. M. Rueth ..... 27,869
Bicycles, Jenkins Cycle Company ..... 27,880
Bicycles, F. A. Lapham ..... 27,881
Bicycles, H. Olson ..... 27,882
Boots and shoes, Little, Maxwell & Company ..... 27,844
Cigars, Hoover Mercantile Company ..... 27,850
Dress shields, Canfield Rubber Company ..... 27,846
Flannels, unshrinkable, William Hollins & Company ..... 27,847
Flour, wheat, H. M. Haas ..... 27,848
Gas heater, Blount & Otto ..... 27,876
Laxative tablets, F. Gruman ..... 27,896
Malto-peptone yeast food and malt extract preparations, Malto-Peptone Company ..... 27,862
Medicinal food, E. O. Taffin ..... 27,861
Medicine, blood, F. Hobart ..... 27,859
Mineral spring water, Tallawanda Mineral Spring Company ..... 27,851
Morocco, patent leather, and goods of that character, P. Rielly & Son ..... 27,843
Paints, stains, fillers, japans, varnishes, and similar articles, Harrison Brothers & Company ..... 27,853
Paper and envelopes, Agawam Paper Company ..... 27,849
Perfumery, extracts, powders, lotions, cosmetics, hair restoratives, and soap, Wood Brothers ..... 27,854
Photographic cameras, Eastman Kodak Company ..... 27,871
Pills, Macdonald, Jameson & Company ..... 27,889
Pins, safety, Oakville Company ..... 27,870
Pipe and boiler covering, non-conductive, New York Asbestos Manufacturing Company ..... 27,873
Plows, cultivators, and their parts and attachments, Southern Agricultural Works ..... 27,893
Polish for wooden surfaces, C. A. Hyde ..... 27,852
Pulleys, D. E. Newell ..... 27,874
Remedies for diphtheria, sore throat, quinsy, croup coughs, and catarrh, R. M. Thompson ..... 27,857
Remedy for snuff, tobacco, and allied habits, D. E. Morgan ..... 27,858
Sewing machines and attachments, except needles, Standard Sewing Machine Company ..... 27,878
Steam traps, Holden & Brooke ..... 27,875
Tea, Bronson, Brown & Company ..... 27,895, 27,896
Tea, G. M. Lane ..... 27,867
Tea, A. Melrose & Company ..... 27,864
Thread, Merrick Thread Company ..... 27,848
Tires, elastic or pneumatic, Boston Woven Hose and Rubber Company ..... 27,879
Tools and hardware, certain named, McCreath & Morgan ..... 27,877
Toothwash, F. S. Churchill ..... 27,865
Toy firearms, Ives & Williams Company ..... 27,872
Wrappers and tea gowns, Ideal Manufacturing Company ..... 27,845

## DESIGNS.

Boiler, tubular steam, J. J. Hogan ..... 25,201
Bracket, D. C. Bowen ..... 25,203
Chair, C. Holstein ..... 25,197
Display stand, E. Greene ..... 25,196
Drum, heading, A. M. Olsen ..... 25,200
Glass vessel, B. F. Bennett ..... 25,194
Lubricating box for friction drums, J. V. Beckman ..... 25,202
Paper box, T. E. Wiedersheim, Jr ..... 25,195
Piano case, S. Brambach ..... 25,198
Sales bin or box, J. A. Flesch ..... 25,199
Spoon, L. R. Horton ..... 25,193

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

## Advertisements.

ORDINARY RATES.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the rule, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

**WOOD or METAL WORKERS**
without steam power can save time and money by using our
**Foot and Hand Power Machinery**
*SEND FOR CATALOGUES—*
*A*—Wood-working Machinery.
*B*—Lathes, etc.
**SENECA FALLS MFG. COMPANY,**
695 Water St., Seneca Falls, N. Y.

**THE ORNAMENTAL IRON INDUSTRY.**—Description of the method of manufacturing wrought iron into ornamental and artistic forms. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1020. Price 10 cents. To be had at this office and from all newsdealers.

POWER & FOOT LATHES. SHAPERS PLANERS DRILLS MACHINE SHOP OUTFITS TOOLS AND SUPPLIES FOR ALL TRADES
S. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

**Universal Surface Gauge**
**FOR TOOL MAKERS.**
5 in. high. 11 ounces. Steel base, case hardened. A most convenient gauge for light work. Price $3.00.
☞ *Catalogue of Fine Tools, free.*
**The L. S. STARRETT CO.**
Box 13, ATHOL, MASS., United States

**THE CURTIS Steam & Grease SEPARATOR**
IT WILL separate water from steam, and so deflect the water that it cannot get back into the current.
IT WILL separate grease and sediment from exhaust steam. The grease may be drawn off at intervals, and the sediment removed. ☞ *Send for Circular S. E.*
**D'ESTE & SEELEY CO.**
29-33 Haverhill Street, Boston.

**Screw Machines**
and General Line of Machine Shop Tools.
**Hill, Clarke & Co.**
160 Oliver St., BOSTON.
16 S. Canal St., Chicago.

**N. Y. CAMERA EXCHANGE**
505 Saved on all makes of Cameras

Headquarters for Buying, Selling, and Exchanging Cameras or Lenses. Large assortment always on hand. *Developing, printing, etc.* Photo supplies of every description at *lowest prices.* ☞ Send 2c. stamp for bargain list. Address
N. Y. CAMERA EXCHANGE, 43 Fulton St., NEW YORK.

GIFFORD PATENT SCREW FRICTION
**CLUTCH PULLEYS**
— AND —
**CUT-OFF COUPLINGS**
Unsurpassed in Power, Durability, and Economy of Space.
**GIFFORD BROTHERS,**
FOUNDERS AND MACHINISTS,
723-737 Columbia St., Hudson, N.Y.

**CHICAGO CHECK PERFORATOR** **Price Reduced to $10**
Protect your Checks and Drafts from Forgers.

Ask your dealer for it or send order direct to the mfrs.,
THE B. F. CUMMINS CO.
232 Clinton Street, CHICAGO. } Dept. A.
89 Nassau Street, NEW YORK. } Dept. B.

**BALL BEARING AXLES AND RUBBER TIRES.**—A paper read before the Carriage Builders' National Convention, Philadelphia, October, 1894, showing the advantage to be derived from the use of ball bearings and pneumatic tires in road vehicles. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 994. Price 10 cents. To be had at this office and from all newsdealers.

**Brazing Stand**
For Bicycle Manufacturers, Repair Shops, and Tool Room purposes. . . . . .
Buffalo Dental Manufacturing Co., Buffalo, N. Y.

**Combined Bolt Cutting, Nut Tapping Pipe Threading and Cutting-off Machines with Opening Dies.**
SUPERIOR QUALITY.

☞ *Send for Catalogue.*
WILEY & RUSSELL MFG. CO., Greenfield, Mass., U. S. A.

**NICKEL AND ELECTRO-PLATING**
Apparatus and Material.
THE Hanson & Van Winkle Co.
Newark, N. J.
81 LIBERTY ST., N. Y.
22 & 24 S. CANAL ST., CHICAGO.

Waverley
BICYCLES.
DO YOU RIDE ONE?
If not, why not? No other wheels in the world stand so high in the estimation of cyclists, because Waverleys are built on honest value lines, and the purchaser receives full value for the investment.
SEND TEN CENTS IN STAMPS FOR A PAIR OF OUR NEW CARD COUNTERS.
ARE MADE IN THE LARGEST AND BEST EQUIPPED FACTORY IN THE WORLD
INDIANA BICYCLE CO.
INDIANAPOLIS, IND.

**THE PERFECT CUFF HOLDER**

fastens cuff to lining of coat sleeve. Holds cuff in same position always. Will save price in laundry bills monthly. Place cuff in position in coat sleeve after coat is on, press down on outside. Jaws of Holder fasten to sleeve lining. Cuffs come off with coat. *Sample pair, prepaid, by mail, 25c.* ☞ AGENTS WANTED. **The Perfect Cuff Holder Co., 85 Dearborn St., Chicago.**

**HELLO, CENTRAL!**
Long Distance Granular Carbon Telephones! The "best" is the cheapest in the long run, and ours are the best. A trial will convince you. Money back if it don't. Exchanges invited to take a pair on trial. Ten styles to choose from. Drop a postal in the slot and get illustrated catalog and particulars by return mail.
PHOENIX INTERIOR TELEPHONE CO.,
131 Liberty St., New York.

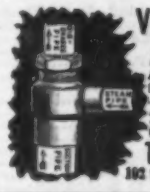
**BUY TELEPHONES**
That are good—not "cheap things." The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits. Our guarantee and instruments are BOTH GOOD.
WESTERN TELEPHONE CONSTRUCTION CO.,
440 Monadnock Block, CHICAGO.
*Largest Manufacturers of Telephones in the United States*

**PERFORATED METAL** OF EVERY DESCRIPTION FOR ALL USES

CHICAGO, ILL. U.S.A. AND 284 PEARL ST. NEW YORK

**DO YOUR OWN PRINTING**
$5. PRESS for cards, circulars, &c. Press for printing a small paper, $15. Save money! Make money printing for others! Type-setting easy. Printed rules. Write for catalogue, presses, type, cards, etc., to factory.
KELSEY & CO.
Meriden, Conn.

**OUR WELL DRILLS**
awarded Highest Medal at the World's Fair.
All latest improvements. Catalogue free.
F. C. AUSTIN MFG. CO., CHICAGO, ILL.



**VANDUZEN STEAM JET PUMP**
THE BEST IN THE WORLD.
*Pumps Any Kind of Liquid.*
Always in Order, never Clogs nor Freezes. Every Pump Guaranteed.
**10 SIZES,**
200 to 12000 Gallons per Hour. Cost $7 to $75 each. Address
THE E. W. VANDUZEN CO.,
102 to 108 E. Second St., Cincinnati, O.

ESTABLISHED 1850.
**THE DEFIANCE MACHINE WORKS**

Sand Belt Machine

DEFIANCE, OHIO, U.S.A.
MANUFACTURERS OF SPECIAL WOOD WORKING MACHINERY FOR HUB, SPOKE, WHEEL, BENDING, WAGON, CARRIAGE, SHAFT, POLE, NECK-YOKE, SINGLETREE, HANDLE & BARREL HOOP FACTORIES.
LARGEST LINE IN THE WORLD
SATISFACTION GUARANTEED.

**WHY NOT** Invest Time, Energy, and Brains Successfully?
The Opportunity for Live Men with or without Technical Knowledge.
**CONCRETE** The Coming Building Material.
**Concrete and Twisted Iron** construction ahead of all other systems in effectiveness, universality, and simplicity.
**Concrete Surfaces** (pitched, nigged, or tooled). The resemblance between these and natural stone is perfect.
UNSIGHTLY CRACKS prevented by shrinkage joints, invisible, unobjectionable.
CONCRETE WALLS built plumb by easily handled and economical molding apparatus.
SIDEWALK LIGHTS—Ransome's Monolithic—latest, cheapest, and best.
RANSOME'S PATENT RIGHTS sold for States, counties, cities, or buildings.
DRAWINGS, CIRCULARS, and complete information upon application.
**RANSOME & SMITH CO.,** 622 Boyleston Building, CHICAGO.

**R. POOLE & SON CO.,**
ENGINEERS, FOUNDERS AND MACHINISTS,
BALTIMORE, MD.
MANUFACTURERS AND DESIGNERS OF ALL KINDS OF
**HEAVY MACHINERY,**
REQUIRING FIRST CLASS WORKMANSHIP AND MATERIALS.
HAND, HOSE AND FLY WHEELS. FRICTION CLUTCHES. MACHINE MOLDED PULLEYS, SHAFTING AND HANGERS AND PLANED GEARING. POOLE-LEFFEL TURBINE WATER-WHEELS.
CIRCULARS ON APPLICATION

*If you want any* **Rope** *For Transmission of Power*
WRITE TO US.
We have furnished Rope for some of the largest drives in the country.
**H. CHANNON COMPANY,**
24-26 Market St. CHICAGO.

**LITTLE GIANT BOLT CUTTERS and NUT TAPPERS.**

Complete with Tap Chuck, Taps, Dies, and Collets Cutting 9 sizes, from ¼ to 1 inch. Has improved clutch on spindle for running die off after thread is cut, making quick return.
☞ *Send for fully illustrated catalogue.*
WELLS BROS. & CO., P. O. Box B, Greenfield, Mass.

**ARMSTRONG'S • PIPE • THREADING —AND— CUTTING-OFF MACHINES**

Both Hand and Power.
Sizes 1 to 6 inches.
Water, Gas, and Steam Fitters' Tools. Hinged Pipe Vises, Pipe Cutters. *Stocks and Dies universally acknowledged to be* THE BEST. ☞ *Send for catalog.*
THE ARMSTRONG MFG. CO.
Bridgeport, Conn.

Indispensable to all drivers.

**SELF RELEASING Breeching Hook**
Safety, economy, and convenience. U. S. and Foreign Patents for sale or to manufacture on royalty. Sample. H. P. VAN WAGNER, Stony Creek, Ont., Can.

**How to Build a Home**

Those intending to build will find the very best practical suggestions and examples of Modern Architecture in the handsomest Architectural Magazine ever published . . .

**"The Scientific American Building Edition."**

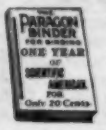
Each number is illustrated with a *Colored* plate and numerous handsome engravings made *direct from photographs of buildings*, together with interior views, floor plans, description, cost, location, owners' and architects' names and addresses. The illustrations include seashore, southern, colonial and city residences, churches, schools, public buildings, stables, carriage houses, etc.

All who contemplate building, or improving homes or structures of any kind, have in this handsome work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

PUBLISHED MONTHLY. SUBSCRIPTIONS $2.50 A YEAR. SINGLE COPIES 25 CENTS.
For sale at all news stands, . . . . . or address **MUNN & CO., Publishers, 361 Broadway, New York**

**HOME STUDY**
An Elementary Journal
FOR TECHNICAL STUDENTS
Including all readers of Technical Books and Periodicals. Mechanical and Architectural Drawing Exercises. HOME STUDY makes a Specialty of teaching its readers how to make and read Mechanical and Architectural Drawings. Sample copy sent free on application
Address, HOME STUDY, Scranton, Pa.

**MAGNETO BELLS** ALL KINDS PRICES OF PARTS **TELEPHONES** ELECTRICAL SUPPLIES
SEND STAMP FOR CATALOGUE. MIANUS ELECTRIC CO. MIANUS, CONN.




**BINDERS**
With the Paragon Binder, SCIENTIFIC AMERICAN can be bound, as received each week, in book form. Every paper in neat order for reference or future reading. Binder guaranteed.
☞ Sent, postpaid, **20 cents** each.
CHAS. W. HERRY,
129 Lincoln Place, BROOKLYN, N. Y


-- THE --
**SCIENTIFIC AMERICAN**

☞ **ESTABLISHED 1845.**
**The Most Popular Scientific Paper in the World**
**Only $3.00 a Year, Including Postage.**
**Weekly—52 Numbers a Year.**

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year* - 52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of Three Dollars by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Postmasters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to
MUNN & CO., 361 Broadway, New York.

## Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

*The most important Engineering Works*, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT, for the United States, Canada, and Mexico, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year to one address for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,
MUNN & CO., 361 Broadway, New York.

## Building Edition.

THE SCIENTIFIC AMERICAN BUILDING EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates* and other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with Floor Plans, Descriptions, Locations, Estimated Cost, etc.

The elegance and cheapness of this magnificent work have won for it the Largest Circulation of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to
MUNN & CO., 361 Broadway, New York.

## Export Edition

of the SCIENTIFIC AMERICAN, with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN is published monthly, and is uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places *throughout the world*. $5.00 a year, postpaid, to any part of the world. Single copies, 25 cents.

☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost. Rates upon application.
MUNN & CO., Publishers.
361 Broadway, New York.

*Founded by Mathew Carey, 1785.*

HENRY CAREY BAIRD & CO.
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.
Our New and Revised Catalogue of Practical and Scientific Books, 90 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

The Philosophy of Science
Popular Scientific Lectures by Ernst Mach. Send for circular No 10, for full particulars and sample copies of periodicals. OPEN COURT PUB. CO., Chicago.

You will be surprised at the splendid appearance of THE INLAND PRINTER, and the quality of its reading matter is fully up to its high standard of excellence typographically. Full of well written articles and valuable hints for every department of the printing office. $2.00 per year; $1.00 for six months. The Inland Printer Co., 212-214 Monroe Street, Chicago; 191 Potter Building, 38 Park Row, New York.

STATISTICS OF THE UNITED STATES.—Abstract of a work by Mr. Henry Gannett, giving some remarkable and little known facts that tell of the growth, the present condition and the resources of the United States. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1011. Price 10 cents. To be had at this office and from all newsdealers.

Automatic Circular Rib Knitting Machinery
for all kinds of Ribbed Goods, Vests, Pants, Sleeves, Sweaters, Tights, Skirts, and everything known to the trade as ribbed goods.
SNYDER & FISHER,
LITTLE FALLS, N. Y.

ALCO VAPOR LAUNCH.

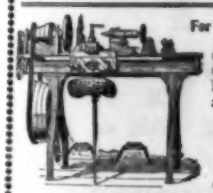
Engine and helm controlled from bow. Latest improved and only 12 to 1 motor now ready for the market. 18 to 40 ft. launches 3, 5, 5 and 7 h. p. No licensed engineer or pilot required. Speed and safety guaranteed. No dangerous naphtha or gasoline used.
Marine Vapor Engine Co., Jersey City, N. J.

GASOLINE ENGINES.

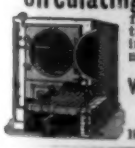
1½ to 75 horse power. For Propelling Boats of all kinds. Cheapest Fuel, Absolute Safety. No Licensed Engineer, Simple Construction, Hundreds in Successful Use.
Write for illustrated catalogue.
GLOBE GAS ENGINE CO.,
Merion Avenue & 49th Street, PHILADELPHIA, PA.

The Chicago Gas & Gasoline Engine

The simplest gas and gasoline engine on the market. Has no equal for absolute, steady speed and durability. It is a dwarf in size and a Samson in strength. *Catalogue sent on application.*
MANUFACTURED BY
J. J. NORMAN CO.,
48 "A" South Clinton St.,
CHICAGO, ILL.

FOOT POWER LATHES

For Electrical and Experimental Work
Gunsmiths and Tool Makers
General Machine Shop Work
Bicycle Repair Work
High Grade Tools
Correct in Principle
Elegant in Design
Superior in Construction
THE BEST FOOT POWER LATHES MADE. CATALOGUE FREE
W. F. & JOHN BARNES CO.
1999 RUBY STREET, ROCKFORD, ILLS.

Durable—Easily Applied.
This roofing is manufactured from natural Trinidad asphalt materials, and will not dry up and become brittle under exposure to the weather as coal-tar roofings do. *Send for free sample of roof 12 years old, with circular and price list to*
WARREN CHEMICAL & MFG. CO.,
85 Fulton Street, New York, U. S. A.

Reagan Feed Water Heating, Water Circulating and Shaking Grates

for Stationary, Marine, and Locomotive Boilers. AGENTS WANTED in all parts of the United States to manufacture our grates on royalty.
*Send for Catalogue.*
Water Circulating Grate Co.
Manuf's and Sole Proprietors
GENERAL OFFICE & WORKS,
1026-1028 Filbert St., PHILA., PA.

THE MODERN ICE YACHT.—BY Geo. W. Polk. A new and valuable paper, containing full, practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts of the latest, most approved forms. Illustrated with engravings drawn to scale, showing the form, position, and arrangement of all the parts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 624. Price 10 cents. To be had at this office and of all newsdealers.

GATES ROCK AND ORE BREAKERS

OVER 3000 IN USE THROUGHOUT THE WORLD
GREATER CAPACITY USING LESS POWER THAN ANY OTHER ON EARTH
MODERN MINING MACHINERY OF EVERY DESCRIPTION
GATES IRON WORKS
550 ELSTON AVE CHICAGO

"THE . . . . LIGHT RUNNING" DENSMORE "THE WORLD'S . . . . GREATEST TYPEWRITER."
The Densmore has the most convenient system of scales. There is no guesswork in using them. They do not go up in the air when you turn the platen to inspect the work and need them most. With work in full sight, you can move the carriage with ease and certainty to any point of the writing.
SUMMARY OF SUPERIORITIES ESTABLISHED: Lightest Key Touch, Greatest Speed, Most Convenient Paper Feed, Platens Changed the Quickest, Handiest System of Scales. *Free descriptive pamphlet with testimonials from the U. S. Government and leading Concerns.*
DENSMORE TYPEWRITER CO., 316 Broadway, New York

The Success of the AMERICAN TYPEWRITER $8
is due to its capacity for doing the best work, and lots of it.
7500 of the New Model No. 2 sold since last July.
It is simple, durable and always goes.
In combination with the Duplicator 150 copies can be made in one-half hour.
*Send for handsomely illustrated catalogue to*
THE AMERICAN TYPEWRITER CO.,
267 Broadway, New York, N. Y.

They have a tone that's all their own. . . . . .
THE NEW DEPARTURE BELLS are the standard of excellence the world over. Made in 16 different styles and prices. Send postal for booklet to THE NEW DEPARTURE BELL CO., 210 North Main Street, Bristol, Conn., U. S. A.

ACETYLENE GAS AND CARBIDE OF calcium.—All about the new illuminant, its qualities, Chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Apparatus for making the gas. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035 and 1038; also SCIENTIFIC AMERICAN, Nos. 13, vol. 72; 23, vol. 73; and 1, vol. 74. Price 10 cents each. To be had at this office and from all newsdealers.

EMPIRE
• BOILER CLEANER •
COMPOUND
We Don't Offer Gratuities, but our Circular will give you the information that will enable you to Save Time, Trouble and Money. *Tried, approved, and being used by the Largest Railways and Factories in the East.*
OFFICE:
Kemble Bldg., 19 Whitehall St., N.Y.

MESSRS. MUNN & CO., Solicitors of Patents, have had nearly fifty years' continuous experience. Any one may quickly ascertain, free, whether an invention probably is patentable by writing to Munn & Co. Communications strictly confidential. A handbook of patents and how to obtain them sent free.
PATENTS
taken through Munn & Co. receive special notice in the *Scientific American*. This splendid weekly paper, elegantly illustrated, has the largest circulation of any scientific work. $3 a year. Specimen copies free.
Address MUNN & CO.,
New York, 361 Broadway.

WATER MOTORS
GAS ENGINES & VENTILATING FANS
The best Motor in the world for driving all kinds of light machinery, noiseless, neat, compact; invaluable for blowing church organs, running printing presses, coffee mills, ventilating fans, ice cream freezers, meat choppers, etc. In use the world over, and recommended by water companies everywhere. Address for circular, Hackus Water Motor Co., Newark, N. J., U.S.A.

Eclipse Cream Separators
are Closest Skimmers, Most Durable, Easiest Running, and far the Simplest Hand or Power Separator on the market. *Agents Wanted.*
C. L. CHAPMAN SEPARATOR WORKS,
LITTLE FALLS, N. Y.

DO YOU USE GRINDSTONES?
If so, we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. *Ask for catalogue.*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

TUBULAR DRIVING LAMP.

IT is the only perfect one.
IT will not blow or jar out.
IT gives a clear, white light.
IT is like an engine headlight.
IT throws the light straight ahead from 200 to 300 ft.
IT burns kerosene.
*Send for book (free).*
R. E. DIETZ CO., 60 Laight Street, New York.
*Mention this paper and get special discount.*
ESTABLISHED 1840.

Chain BELTING of Various Styles, ELEVATORS, CONVEYORS, COAL MINING and HANDLING MACHINERY.
The JEFFREY MANUFACTURING CO., COLUMBUS, O.
*Send for late Catalogue "O."* Branches: CHICAGO—NEW YORK.

INCUBATORS
Brooders, Vegetable and Clover Cutters.
BONE AND GRAIN MILLS.
A complete line of poultry supplies at lowest prices. Green cut bone will MAKE HENS LAY in Winter and produce fertile eggs for hatching. Send 4c. for catalog and valuable information on poultry raising.

Absolutely Self-Regulating.
Peerless Incubator & Brooder Co., 316 "A" Ohio Street, Quincy, Ill.

For $1 currency or stamps, we will send by mail, postage paid, A Sample
PENBERTHY Grease Cup

capacity ¼ oz. You will be delighted with it. Send for our catalog of specialties. Penberthy Injector Co.,
116 Seventh St., Detroit, Mich. GREASE CUP

DYNAMOS & ELECTRIC MOTORS
Our 10 to 75 light Dynamos are pronounced a success by all who have them in use. High grade, compound wound, self-oiling, self-aligning bearings, high efficiency and great durability guaranteed. Lowest prices. Do your own lighting, no experience required. *Send for catalogue and prices.* Complete plants furnished.
ROTH BROS. & CO., Mfrs., 30-34 Market Street, Chicago, Ill., U. S. A.

A calculating machine will improve the accuracy of any arithmetical work, and also enable the book-keeper, accountant, civil or mechanical engineer, or man of science, to avoid much labor and save some time. There is no room here for a description, but we should like to send you our interesting pamphlet. Grant Cal Mch Co. Lexington, Mass.

RUST PERMANENTLY PREVENTED on Machinery, Tools, Guns and Cycles with MANNOCITIN
Leading R.R's and Factories use it.
O. GOETZE, Sole U.S. Agt. 21 Whitehall St. N.Y.
Sample Can, 25c. by mail

DEAFNESS
and HEAD NOISES relieved by using Wilson's Common Sense Ear Drums.
New scientific invention, entirely different in construction from all other devices. Assist the deaf when all other devices fail, and where medical skill has given no relief. Safe, comfortable, and invisible; no wire or string attachment. Write for pamphlet.
WILSON EAR DRUM MANUFG. CO., Louisville Trust Co. Building, Louisville, Ky., and 1122 Broadway, New York
*Mention this paper.*

SMALL MOTORS for All Purposes.

The best manufactured. Specially adapted to all kinds of light work, sewing machine outfits toys, dental drills, jewelers' lathes, models, etc. Send for Catalogue. The LEAVITT MOTOR CO., Manufacturers of Electric Motors and Electrical Specialties, 122 Mitchell St., PROVIDENCE, R. I.

MANUFACTURE OF BICYCLES.—A very comprehensive article giving the details of construction of every part of these vehicles. With 15 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 908. Price 10 cents. To be had at this office and from all newsdealers.

STUDY AT HOME Electricity, Mechanics & Steam Engineering
By our unequaled Correspondence Method. ELECTRICAL APPARATUS FURNISHED without extra cost. *Special proposition now open.* The Scientific Machinist Co., 51-52 Blackstone Bldg., Cleveland, O.

WANTED, General Agency. Location established, and 20 yrs. bus. ref. Jos. Driver & Co., Philadelphia.

AGENTS. "Trio Foot Brush." Sure seller. Send address, we do the rest. GREEN MFG. CO., Boonton, N. J.

SCROLL SAWS Foot Power Machinery, Tools, Forges, Drills, etc. Send 4c for catalogue. Wilkinson Co., 88 Randolph St., Chicago

Shorthand by Mail Thoroughly taught by reporters. *Catalogue and first lesson Free.* Potts Shorthand College, Williamsport, Pa.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

DIES Models, Tools, Special and General Machinery made to order. Prices moderate. A. GUENARD 32 to 38 South 6th Street, BROOKLYN, N. Y.

MANY BOATS MEN OF MANY KINDS MINDS FOR
Catalogue. . . . . J. H. RUSHTON, Canton, N. Y.

DRAUGHTING or SURVEYING taught by mail. Earn $60 to $100 a month. Positions secured. 2c. stamp for catalogue. Black Cor. School, Baldimore, Md.

IDEAS DEVELOPED. Absolute secrecy. Send for particulars. Advice and suggestions free. Correspondence and sample orders solicited. 25 years in business. Gardam & Son, 9 John St., New York.

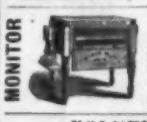
Engineers and Firemen Send 2c. stamp for 24 page pamphlet containing a list of questions asked by a board of examining engineers. Stromberg Pub. Co., St. Louis, Mo.

TURBINE WATER WHEELS.
SEND FOR PAMPHLET.
JAMES LEFFEL & CO., Springfield, Ohio, U. S. A.

DEAF NESS & HEAD NOISES CURED by my Invisible Tubular Ear Cushions. Whispers heard. Warranted to help more cases than all similar devices combined. Helps ears as glasses do eyes. Sold by F. HISCOX only, 853 Br'dway, N.Y. Send for book of proofs FREE

Incubators & Brooders
Best in the world, hot water, pipe system. Will hatch chicks when others fail. Catalogue Free. Shoemaker Incubator Co., Freeport, Ill. U. S. A.

SHOEMAKER'S POULTRY BOOK
96 pages, printed in 6 colors. Birdseye view of largest Poultry Farm. Tells all about Chickens. Prices of same, their Diseases, remedies, poultry buildings, etc.; finely illustrated. Price only 15c. C. C. SHOEMAKER, Freeport, Ills. U.S.A.



INCUBATOR.
A Catalogue of 64 pages. Gives full information of cost of raising poultry and at the least expense. The book is worth dollars to you. Address A. F. Williams, 61 Race St., Bristol, Conn.

VOLNEY W. MASON & CO.
FRICTION PULLEYS, CLUTCHES, and ELEVATORS.
PROVIDENCE, R. I.

CARBORUNDUM
HARDEST ABRASIVE KNOWN. EMERY AND DIAMOND POWDER, SUBSTITUTE. IN FLOUR-POWDER-CRYSTAL-WHEEL-SLAB & HONE FORM.
*CARBORUNDUM CO. NIAGARA FALLS CITY, PA. U.S.A.*

WOODEN TANKS.
For Railroads, Mills and Manufactories. Builders of Steel Towers and Tanks. La. Red Cypress Wood Tanks a specialty.
W. E. CALDWELL CO.,
217 E. Main Street, Louisville, Ky.

FIRE BRICK FOR ALL PURPOSES.
. . . . . *Send for Prices and Catalogue.*
BROOKLYN FIRE BRICK WORKS.
88 Van Dyke Street, BROOKLYN, N. Y.

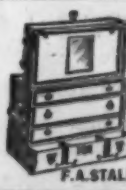
SALESMEN
and LADIES wanted to sell our NEW HOUSEHOLD UTENSILS. $18.00 a week sure. Address—
*Bevеridge Mfg. Co., P. O. 728, Baltimore, Md.*

EDGE TOOLS
are often nearly ruined by using a grindstone not adapted to the work. Our quarries produce a large variety of grits suitable for grinding any tool.

*May we send you our Catalogue, which will give you some information?*
GRAFTON STONE COMPANY,
No. 80 River Street, GRAFTON, OHIO.

"Air Cushion" Rubber Stamps
ALWAYS MAKE A GOOD PRINT.
Stamp, Stencil and Seal Supplies, Wholesale and Retail.
THE R. H. SMITH MFG. CO.,
Springfield, Mass.

STEREOPTICONS. MAGIC LANTERNS AND ACCESSORIES. SEND FOR CATALOGUE. TO CHAS BESELER MAKER 218 CENTRE ST. NEW YORK.


New Idea in Trunks
The *Stallman Dresser Trunk* is a portable dressing case, with *drawers* instead of trays; the bottom is as accessible as the top. Costs no more than box trunk. Shipped C. O. D. with privilege to examine. 2c. stamp illustrated catalog.
F. A. STALLMAN, 61 W. Spring St., Columbus, O.

HYPNOTISM My original method $2. 100 pp. pamphlet 10c. One on Personal Magnetism 10c. Dr. Anderson, S A 3, Masonic Temple, Chicago.

## Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

. . . WE ARE BUILDING . . .
The Celebrated
"HORNSBY-AKROYD"
OIL ENGINE
The De La Vergne Refrigerating Machine Co.
FOOT E. 138TH STREET, NEW YORK.

PRIESTMAN SAFETY OIL ENGINE
PRIESTMAN & COMPANY, Inc.
Front and Tasker Streets, - - Philadelphia

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

The American Bell Telephone Company,
125 Milk Street, Boston, Mass.

This Company owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephone, covering all forms of Microphone Transmitters or contact Telephones.

VICTOR

YOU WILL MAKE NO MISTAKE IF YOU BUY A VICTOR BICYCLE
THE RECOGNIZED LEADER FOR FINE CONSTRUCTION AND EASY RUNNING QUALITIES. THE VICTOR COSTS MORE TO BUILD THAN ANY OTHER BICYCLE
OVERMAN WHEEL COMPANY
NEW YORK BOSTON DETROIT DENVER SAN FRANCISCO LOS ANGELES PORTLAND ORE.

BICYCLES

ENGINES, Boilers and Machine Tools. New and Second-hand. Send stamp for catalogue "Machinery & Supplies." W. P. Davis, Rochester, N. Y.

*On Bosworth Field*
*King Richard cried:*
*"My kingdom for a horse!"*
*But times have changed—*
*To-day he'd want*
*A Monarch wheel, of course.*

MONARCH
KING OF BICYCLES

and a wheel fit for a king. Made in 4 models. $80 and $100. For children and adults who want a lower price wheel the *Defiance* is made in 8 models, $40 to $75. Send for Monarch book.

MONARCH CYCLE MFG. CO.,
Lake, Halsted and Fulton Sts., CHICAGO
83 Reade Street, New York.

DOES ANY-THING PHOTOGRAPHIC—

The Pocket Kodak.

Pocket Kodak, loaded for 12 pictures, 1½ x 2, . . $5.00
Developing and Printing Outfit, . . . 1.50

EASTMAN KODAK CO.
*Sample photo and booklet for two 2-cent stamps.* ROCHESTER, N. Y.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM. JESSOP & SONS LE 91 JOHN ST. NEW YORK

At ¼ Price Scales, Weighing Cans, Counters, Hangers, Gearing, Shafting, Pulleys, Pumps, Belts, Hose, Steam Gauges of all varieties and other articles. Lists free. CHICAGO SCALE CO., Chicago Ill.

THE ACKNOWLEDGED
PERFECT PULVERIZER
Of All Refractory Substances

Is the "Griffin Mill," whose first cost, wear, and operating expense is much less than stamp mills, and which yields a larger product at less cost than any other mill, with perfect success in every instance.

It will work by either the wet or dry process, and deliver a uniformly sized finished product of from 30 to 350 Mesh, with equal facility. Its capacity is 3 to 4 tons per hour on Phosphate Rock, 1½ to 2 tons per hour on Portland Cement, Quartz Ores, etc.

*Correspondence solicited, and illustrated descriptive catalogue sent free by mail on application to*

Bradley Pulverizer Co., No. 92 State Street, Boston.

AGENTS WANTED FOR FINE TOOLS IN EVERY SHOP. WRITE FOR CATALOGUE AND AGENCY. C. H. BESLY & CO. CHICAGO, ILL. U.S.A.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1002. Price 10 cents. To be had at this office and from all newsdealers.

"NAPOLEON" BICYCLES
ARE SUPERB... Catalogue Free
THE JENKINS CYCLE CO.
18 and 20 Custom House Place, Chicago

RIDE THE HUNTER CYCLES
SEND FOR CATALOGUE
HUNTER ARMS CO.
FULTON N.Y.

"IMPROVEMENT THE ORDER OF THE AGE."
Three New Model
Smith Premier Typewriters
—NOS. 2, 3 AND 4
HAVE YOU EXAMINED THEM?
Many Improvements Heretofore Overlooked by Other Manufacturers.
Address THE SMITH PREMIER TYPEWRITER COMPANY, Syracuse, N. Y., U. S. A.
BRANCH OFFICES IN TWENTY-NINE PRINCIPAL CITIES IN THE UNITED STATES.

There is hardly a USE OF POWER

in Factory, Mill, Store, Office, Elevator, Creamery, or Shop—or on the Farm, the
"CHARTER"
is not now filling. It is also running Boats, Well Drills, Pumps, Dynamos, Threshing Machines, etc. Of course it also uses Gasoline.
CHARTER GAS ENGINE CO., P. O. Box 148, Sterling, Ill.

PRINTING INKS.
The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York